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United States Patent [19]

[11] **Patent Number:** **6,119,397**

Metz

[45] **Date of Patent:** ***Sep. 19, 2000**

[54] **EXTENDIBLE AND RETRACTABLE POLE**

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[*] Notice: This patent is subject to a terminal disclaimer.

Primary Examiner—Daniel P. Stodola
Assistant Examiner—Curtis A. Cohen
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak & Seas, PLLC

[21] Appl. No.: **09/404,293**

[22] Filed: **Sep. 24, 1999**

[57] **ABSTRACT**

Related U.S. Application Data

A safety pole is comprised of a strip of plastic material having a normal elongated hollow cylindrical condition with overlapping longitudinal edges. A motor driven drum is mounted within a canister adapted to be recessed in the ground in spaced relation to a loading dock with the strip of plastic material connected at one end to the drum whereby the strip of plastic material may be wound on the drum in a flattened condition or extended vertically upwardly to form a pole. A loading dock is provided with a door and the operation of the motor driven drum is coordinated with the operation of the door so that when the door is open, the pole will be in the extended visible condition to warn a truck driver not to approach or leave a loading dock.

[63] Continuation-in-part of application No. 09/153,038, Sep. 15, 1998, abandoned, which is a continuation-in-part of application No. 08/949,406, Oct. 14, 1997, Pat. No. 5,964,059.

[60] Provisional application No. 60/101,821, Sep. 25, 1998.

[51] **Int. Cl.⁷** **E01F 13/00**

[52] **U.S. Cl.** **49/49; 404/6**

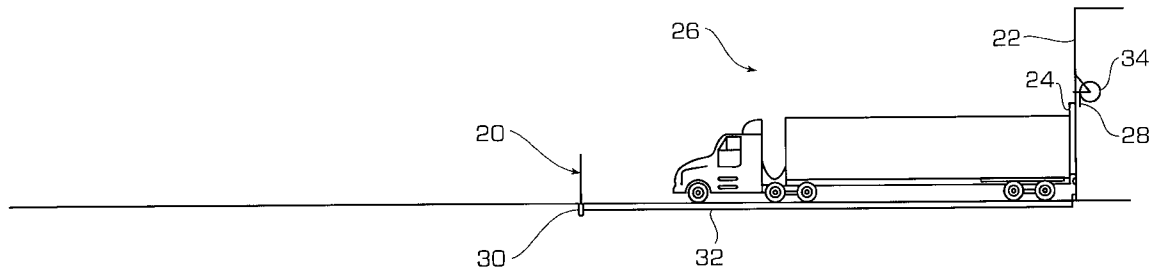
[58] **Field of Search** 49/25, 35, 49, 49/131; 404/6, 9, 11

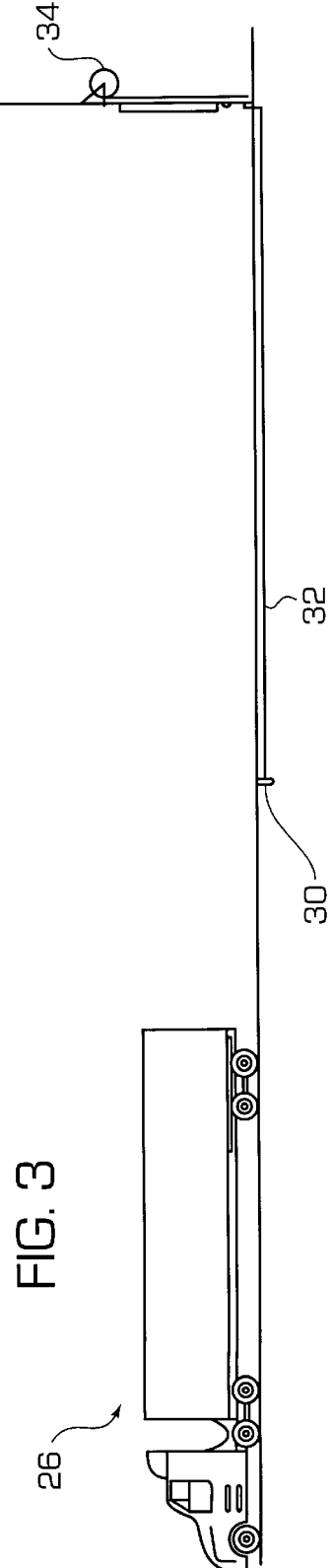
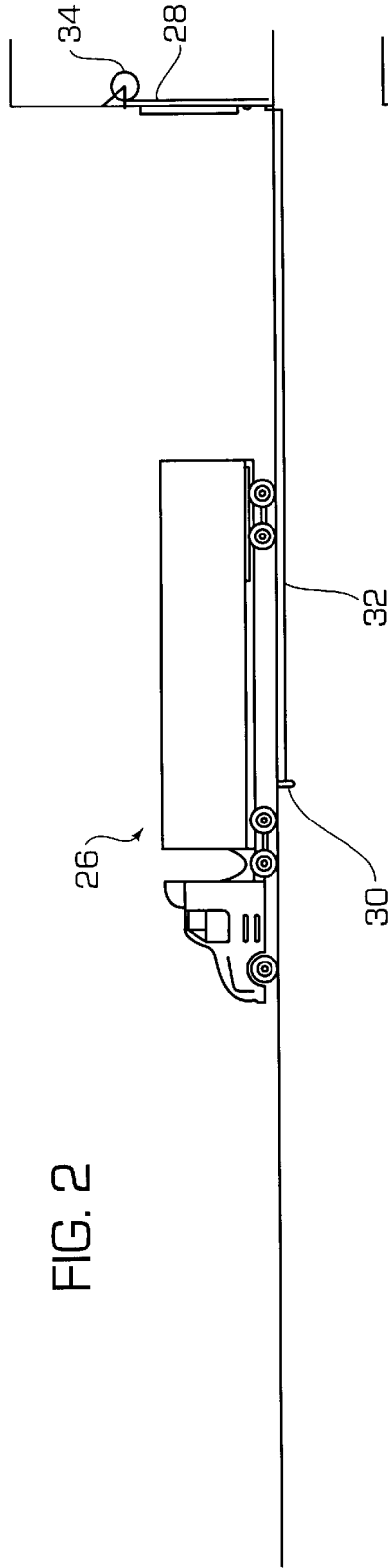
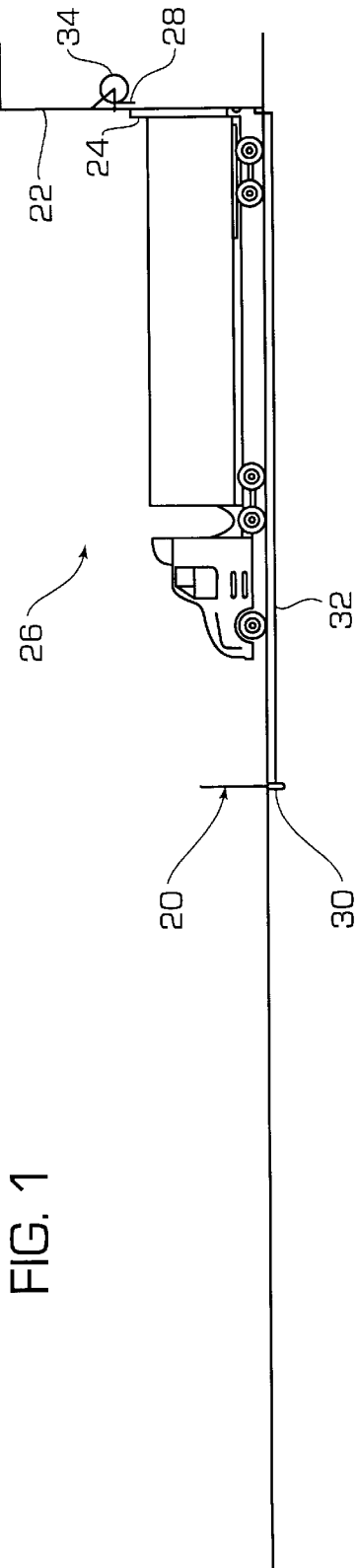
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13 Claims, 26 Drawing Sheets





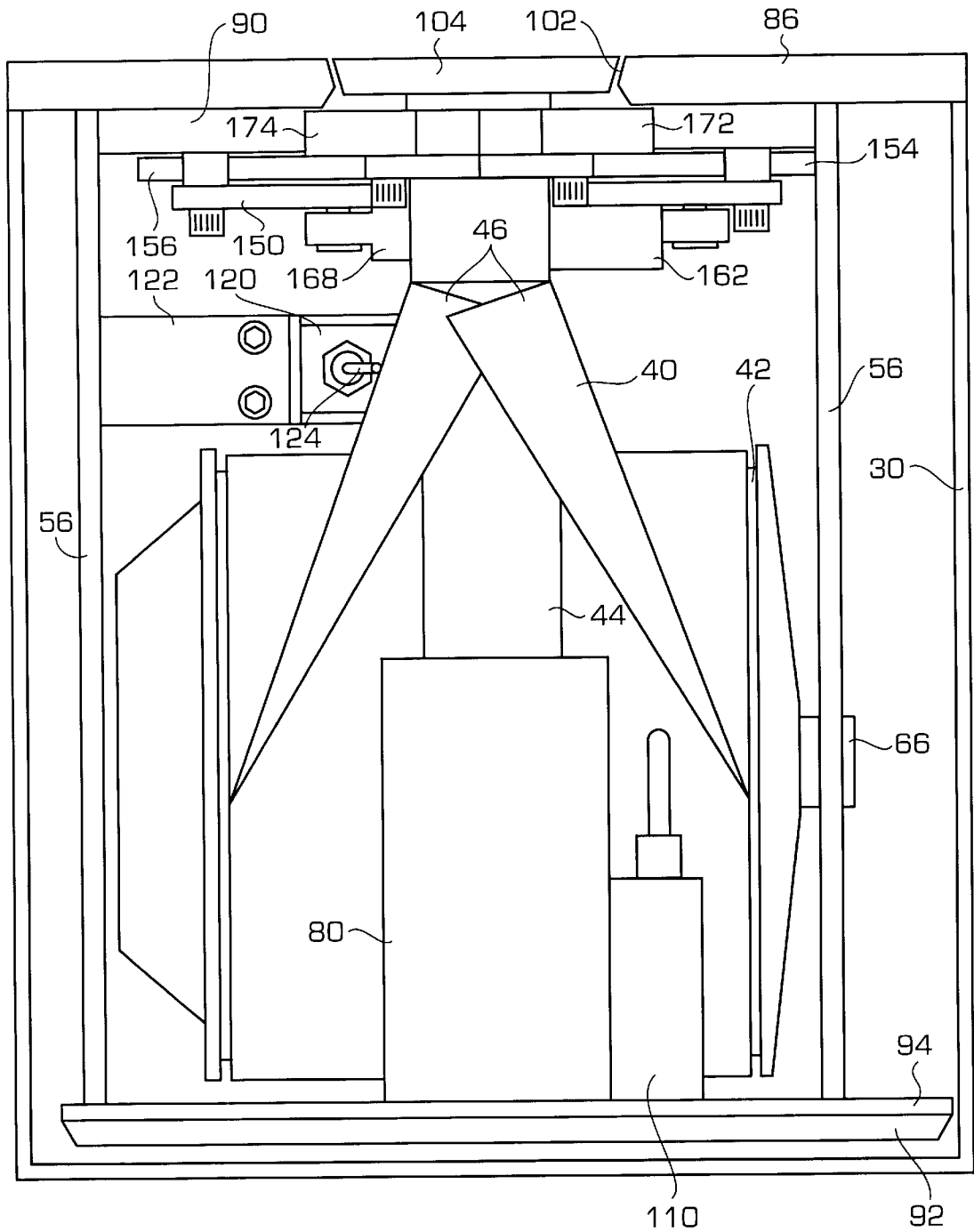


FIG. 4

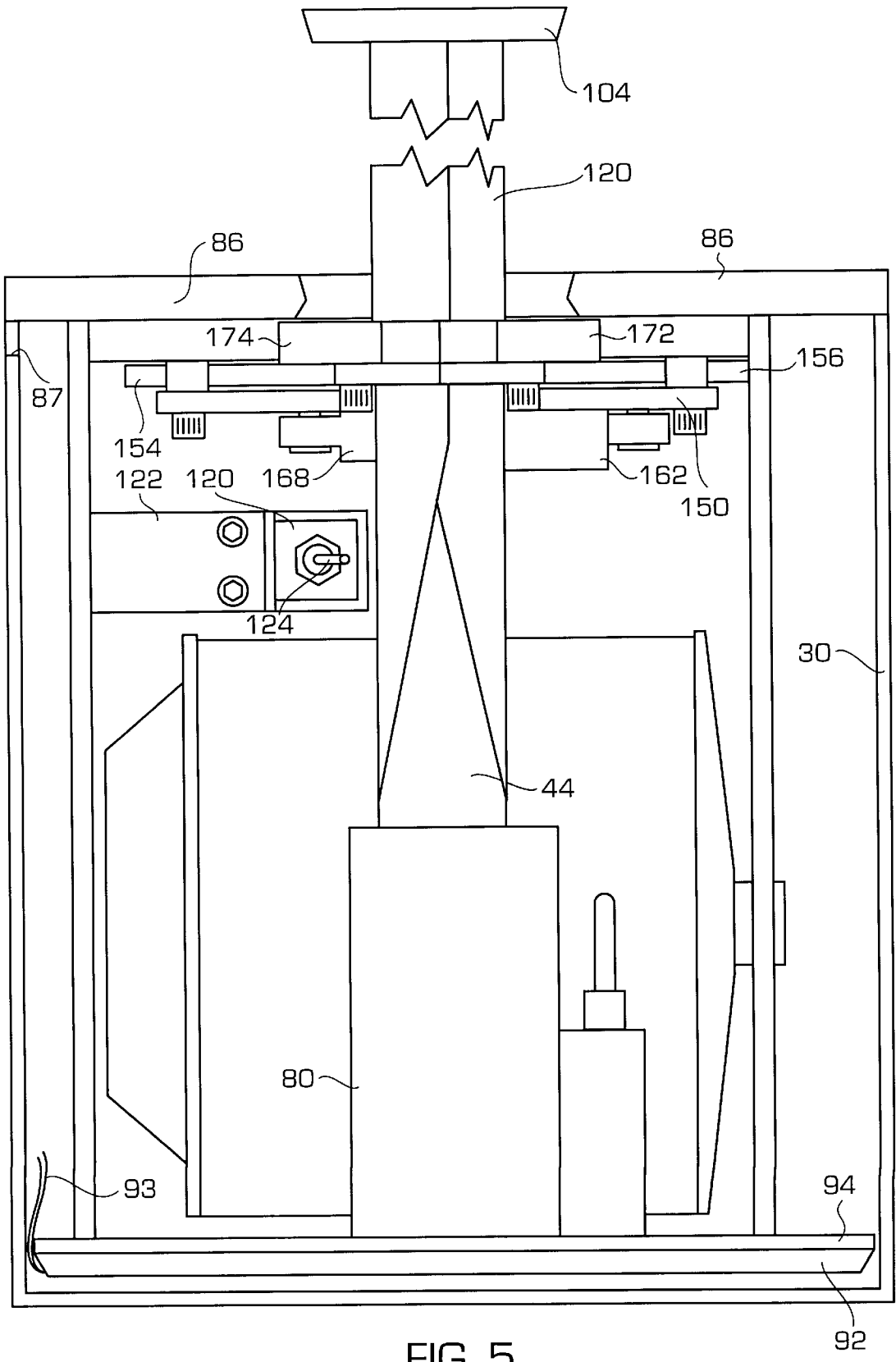


FIG. 5

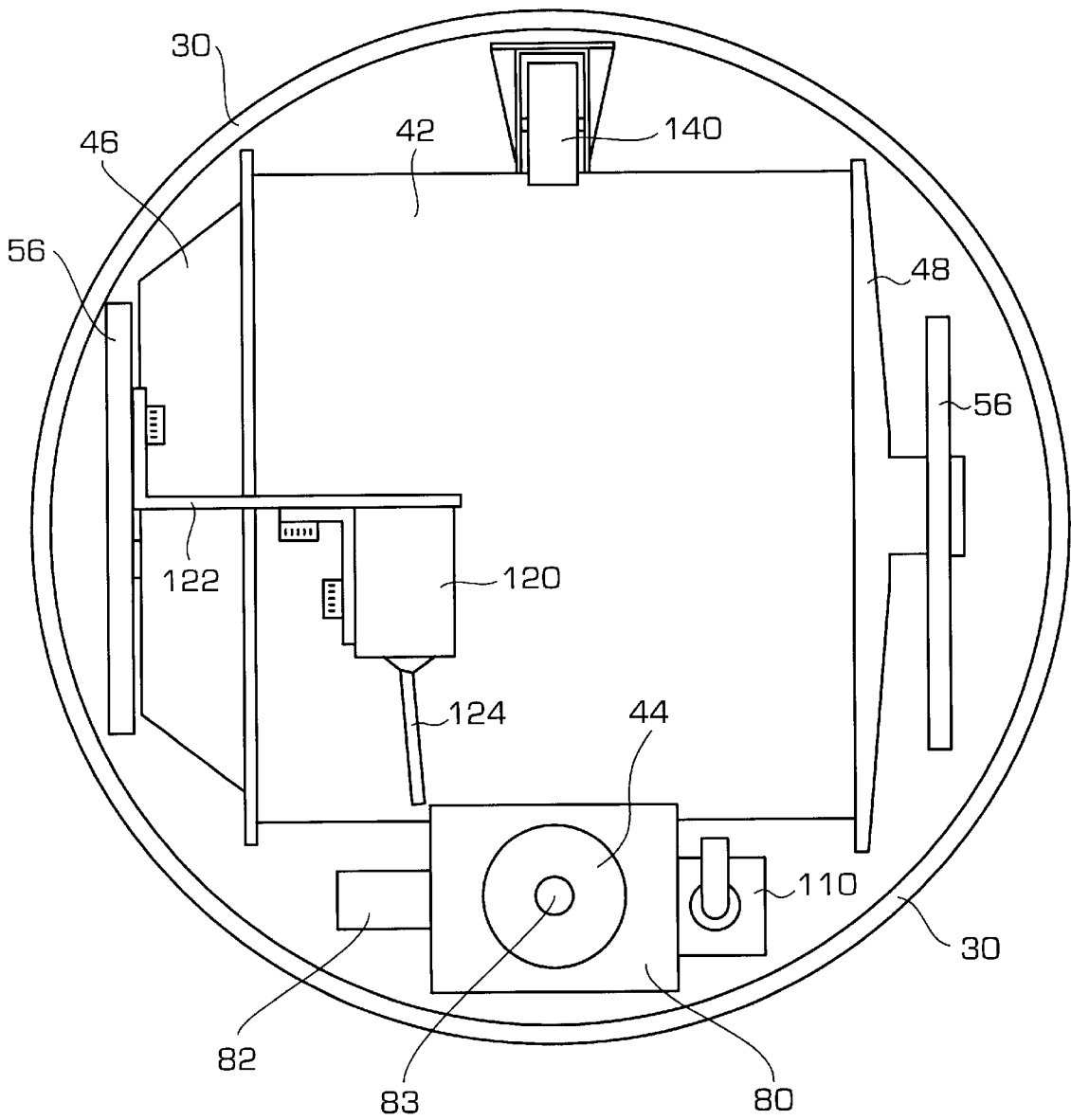


FIG. 6

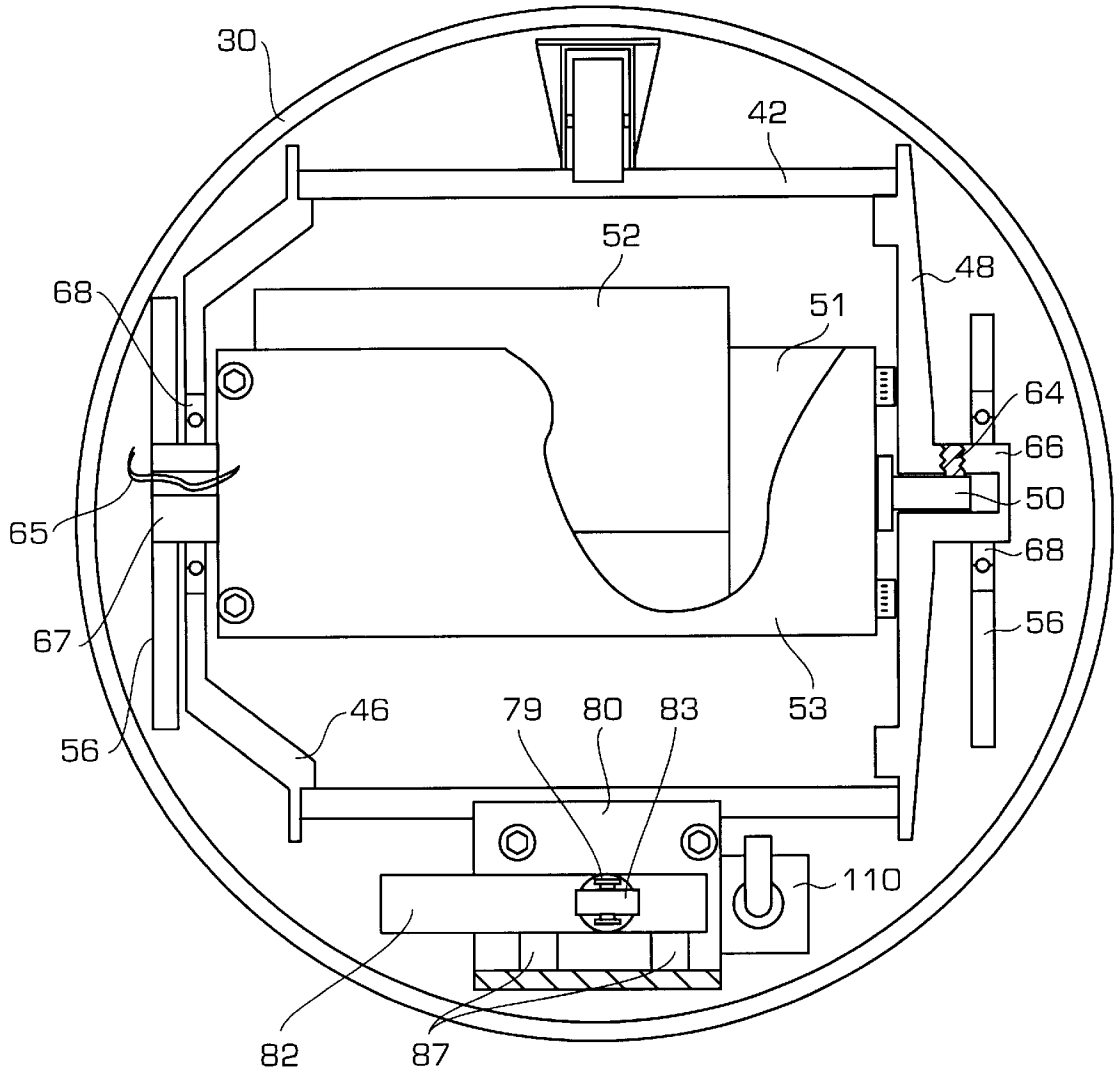


FIG. 7

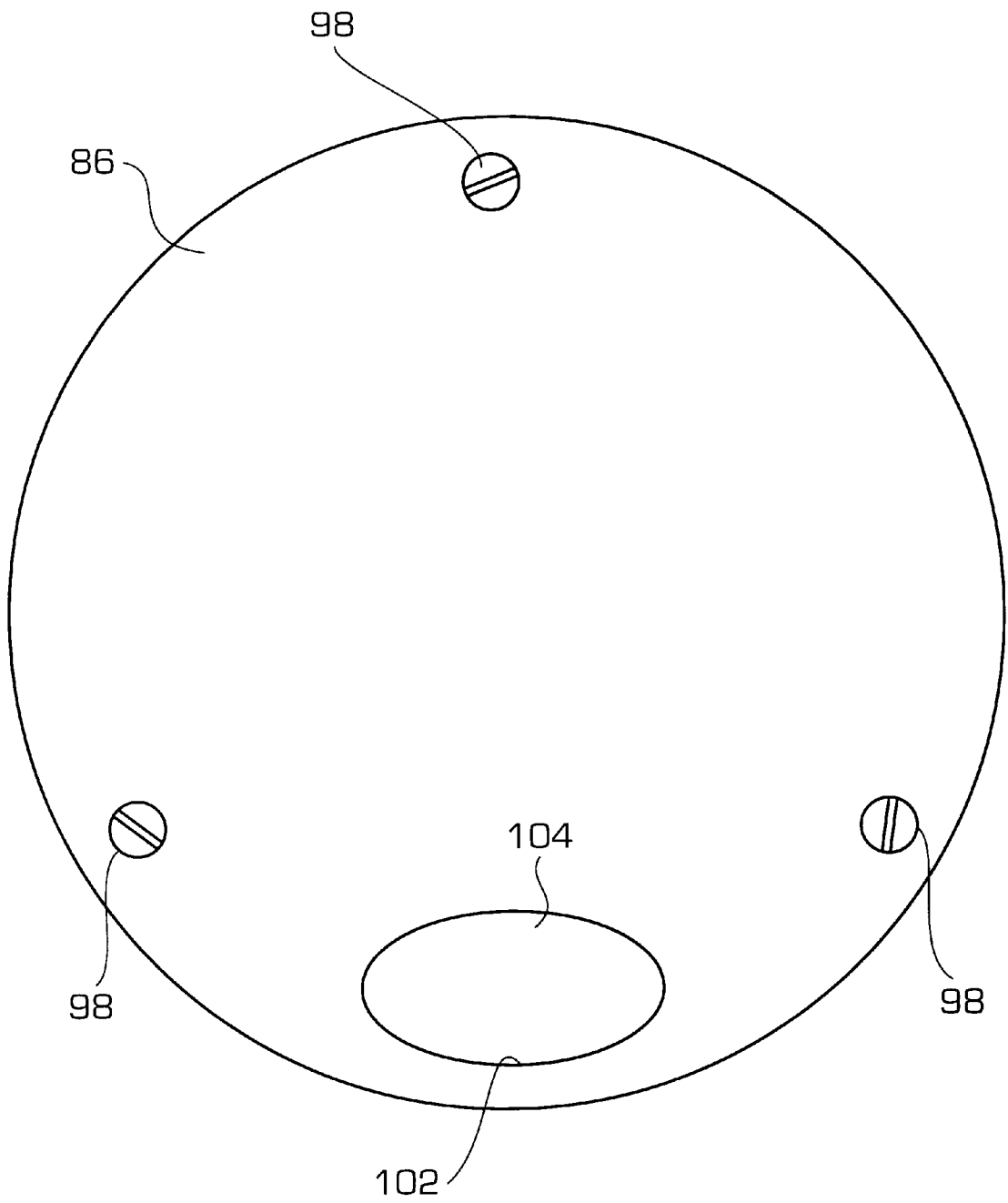


FIG. 8

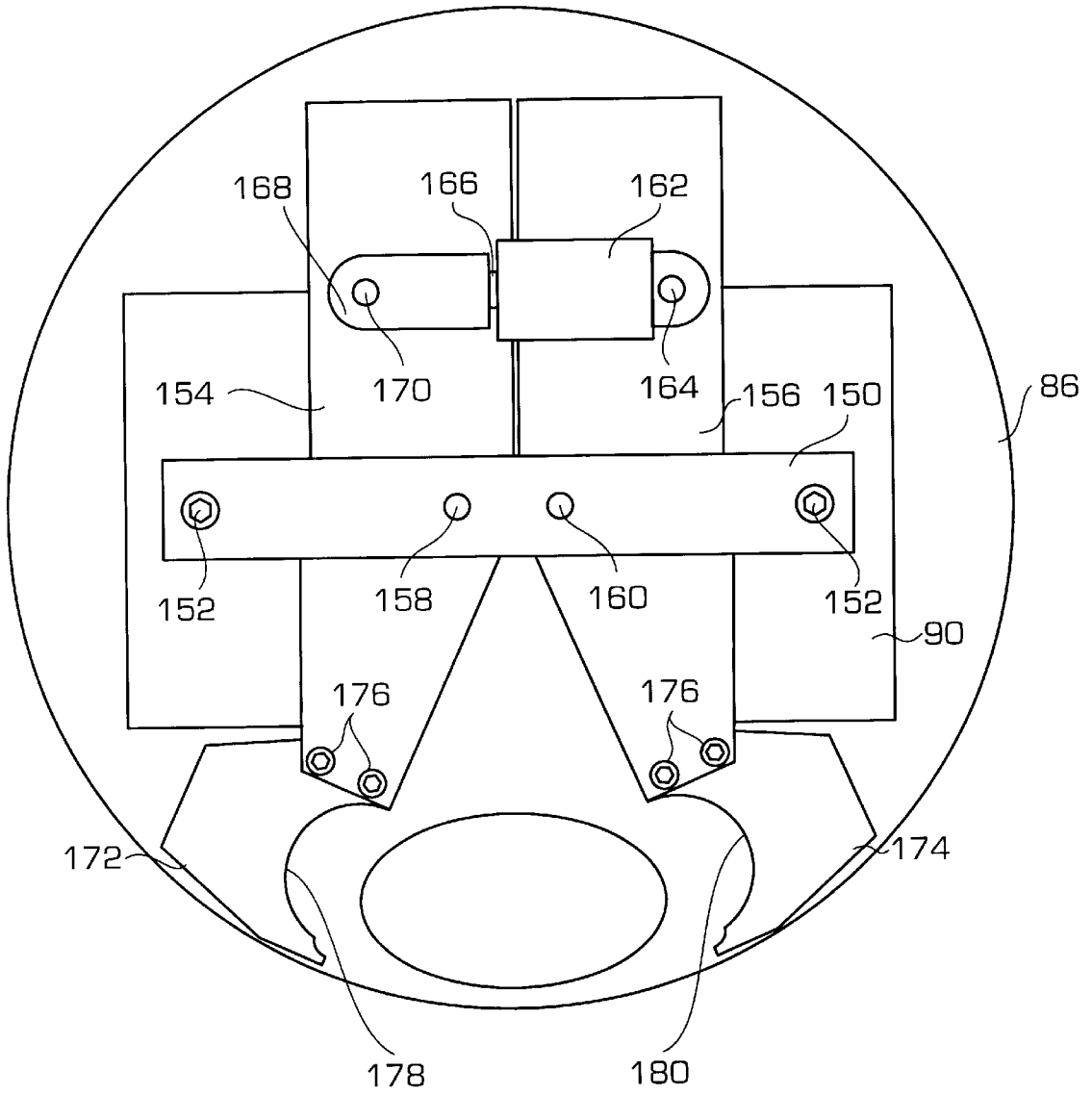


FIG. 9

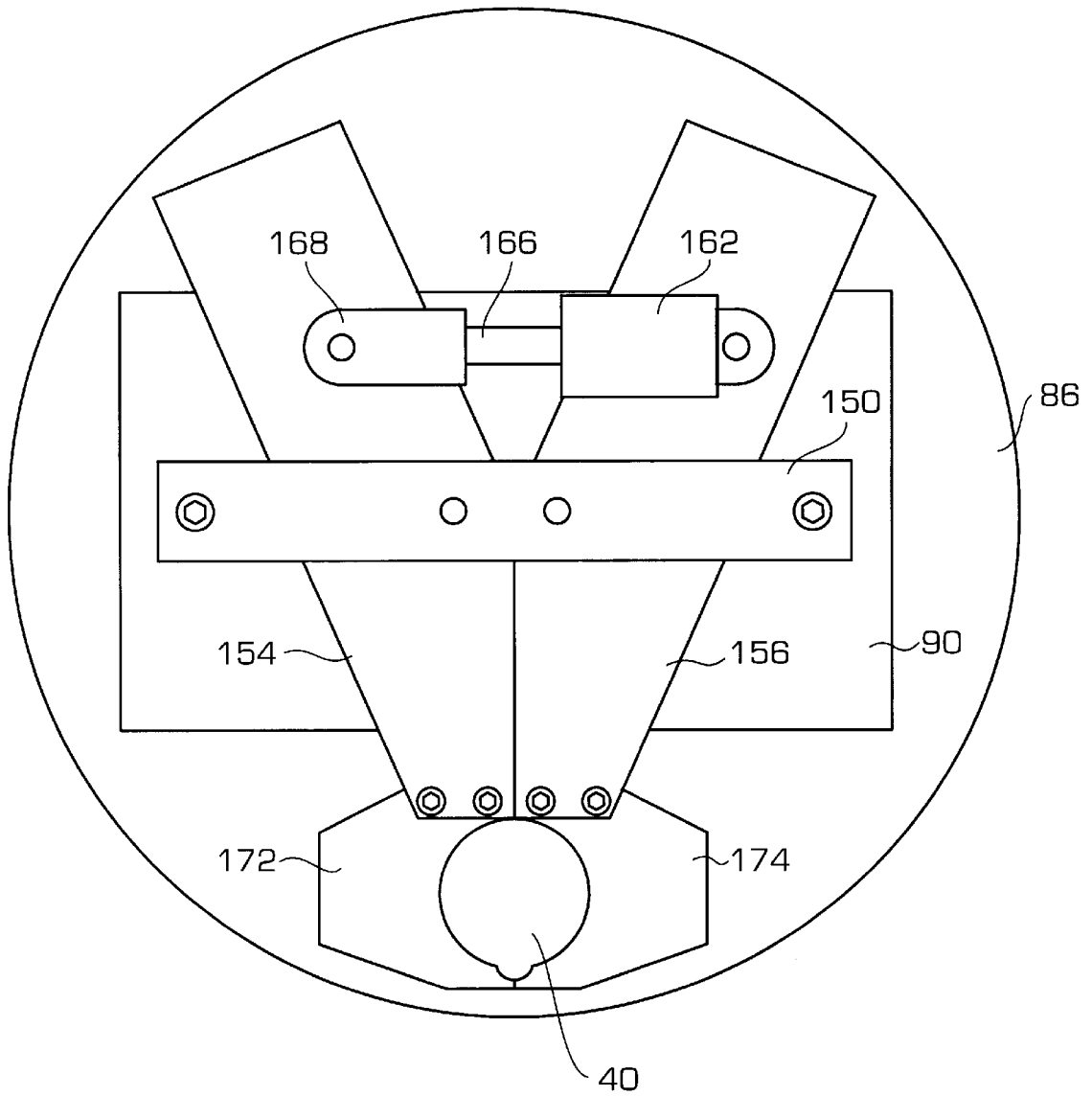


FIG. 10

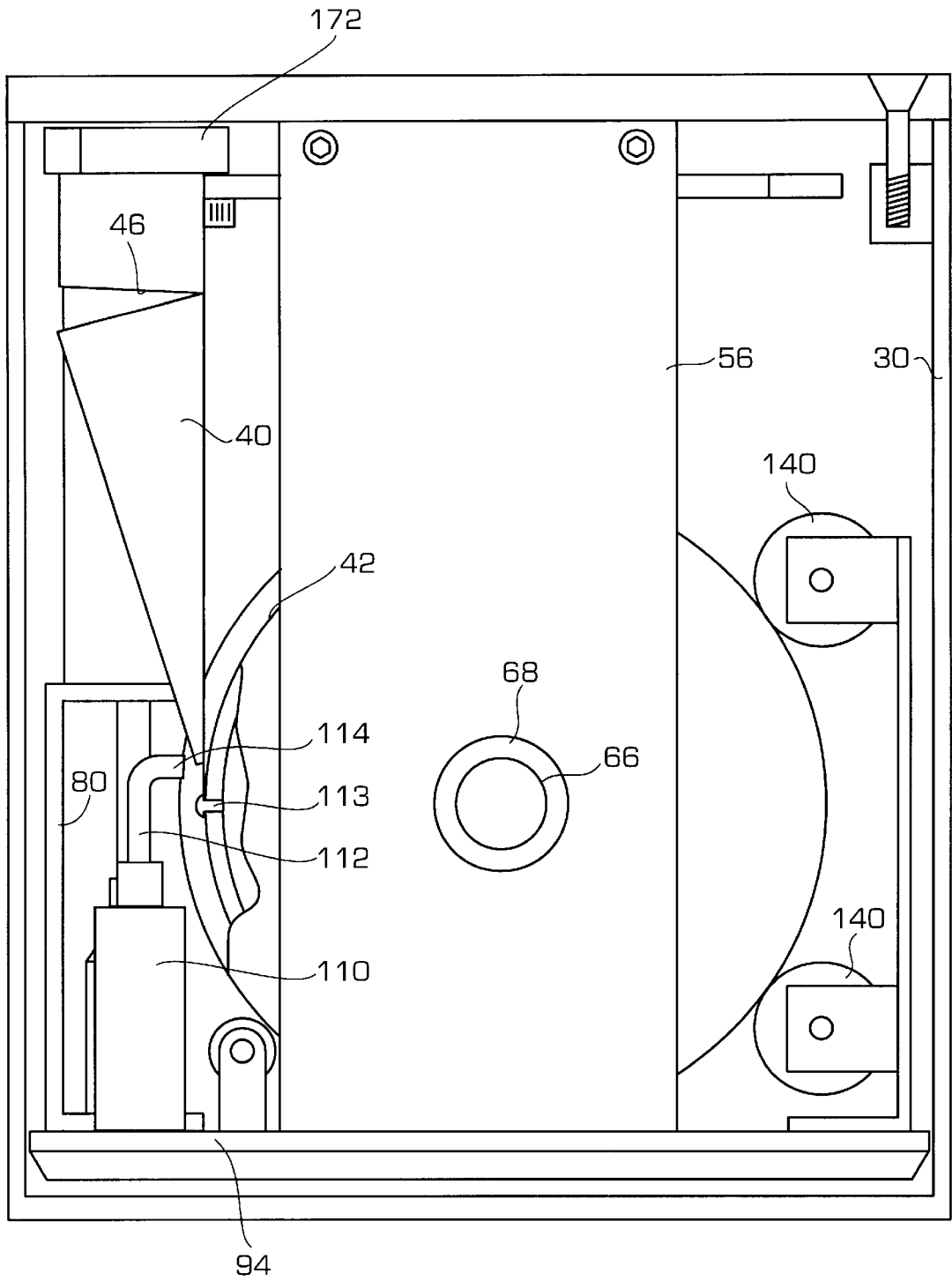


FIG. 11

FIG. 13

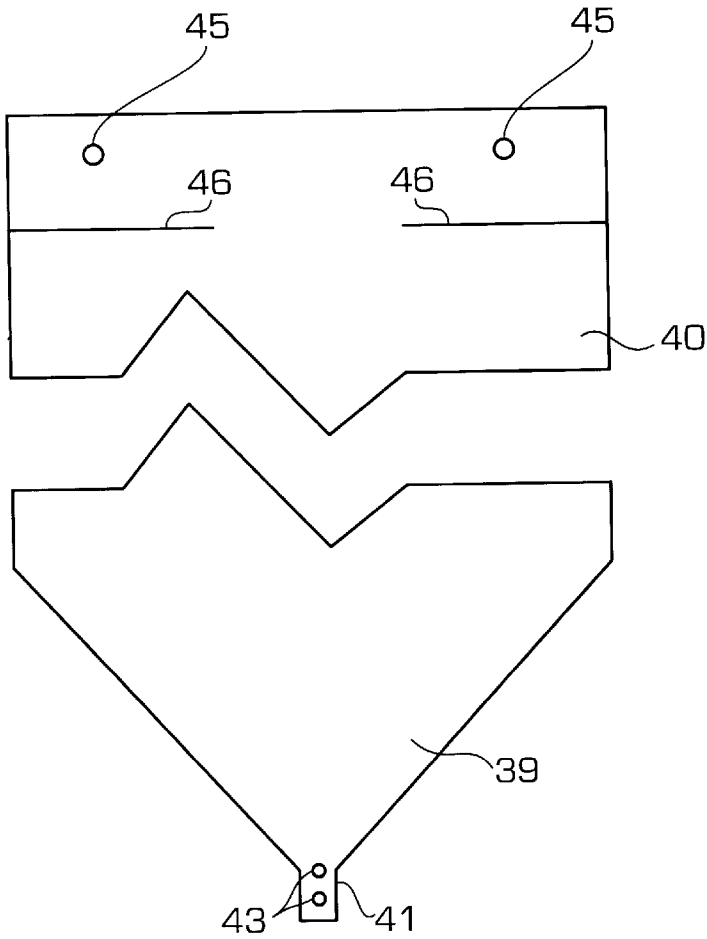


FIG. 14

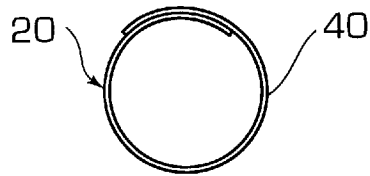
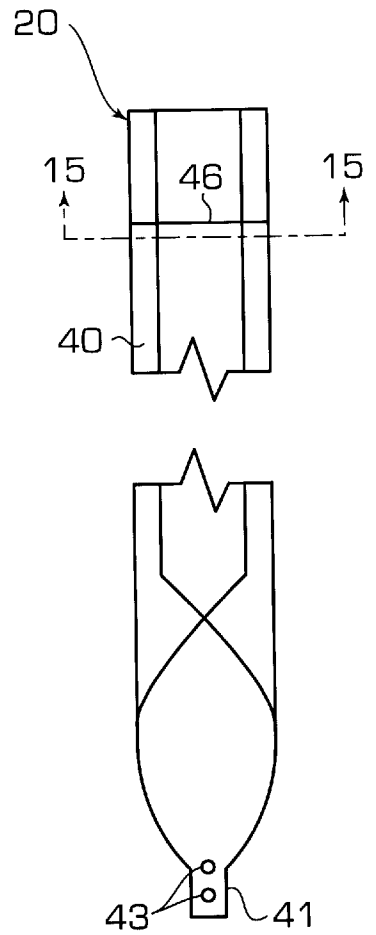


FIG. 15

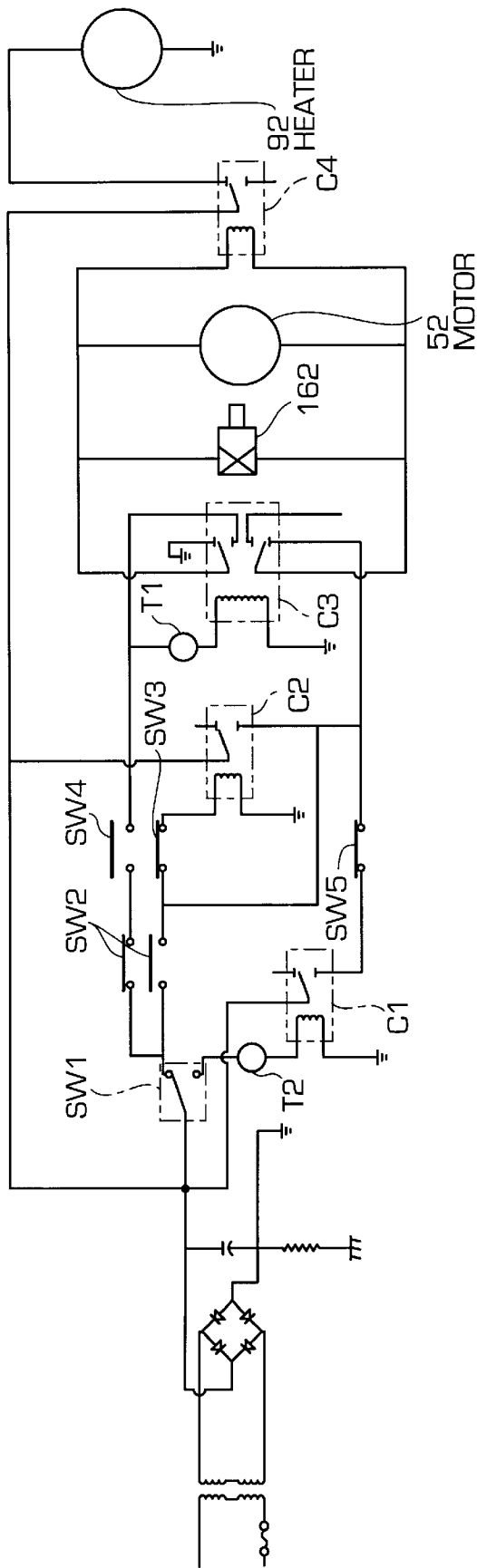


FIG. 16

FIG. 17

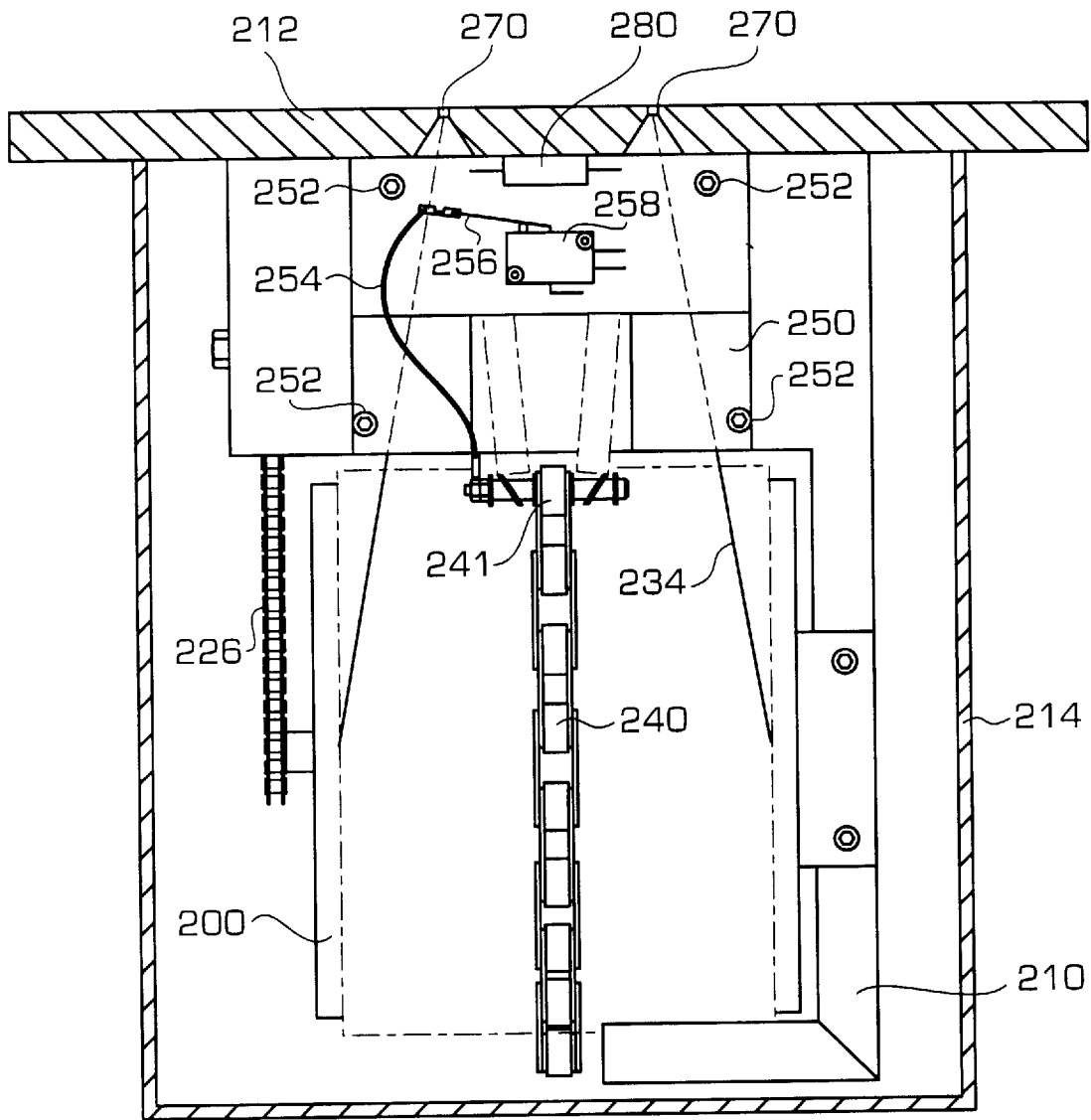


FIG. 18

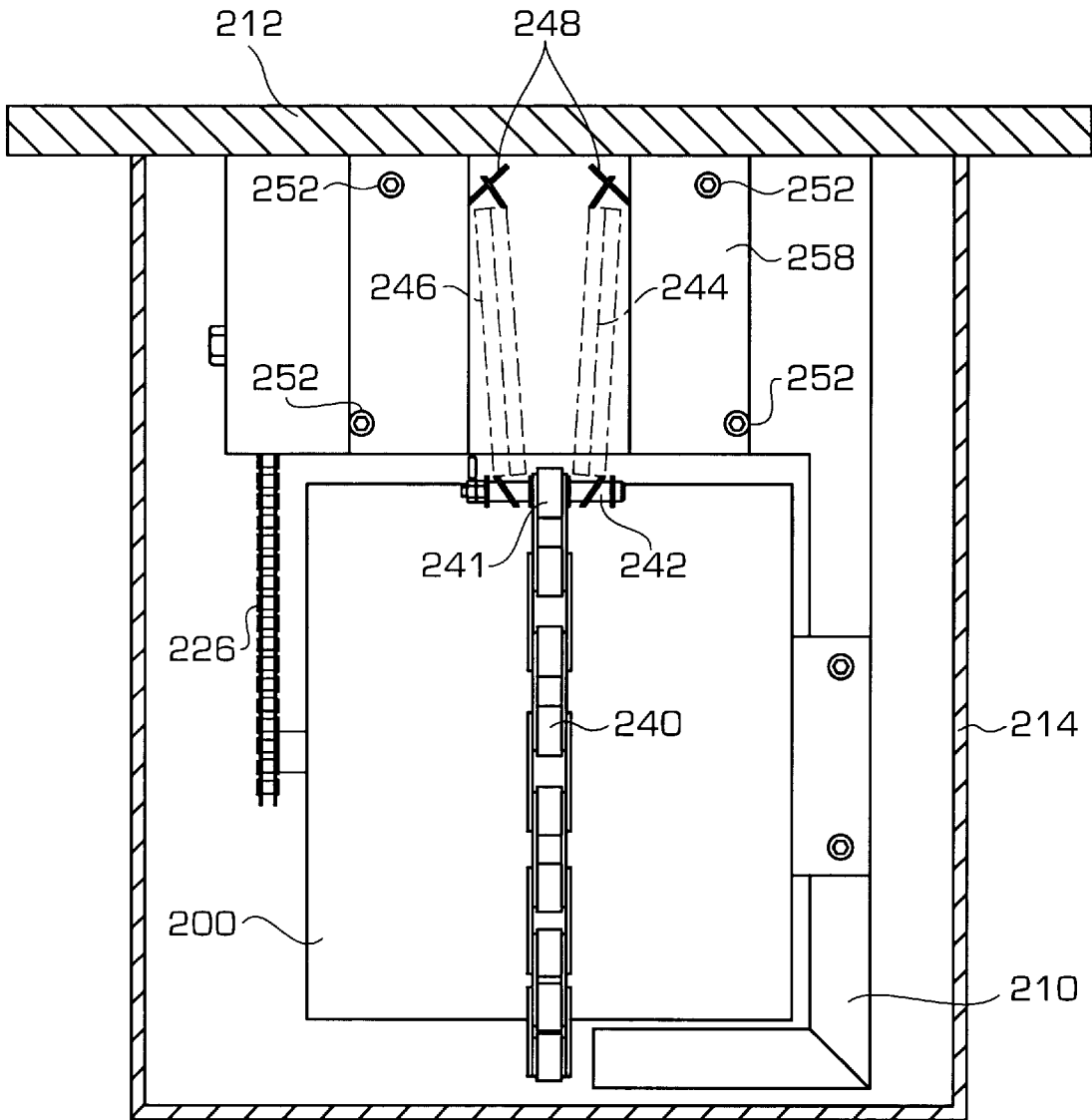


FIG. 19

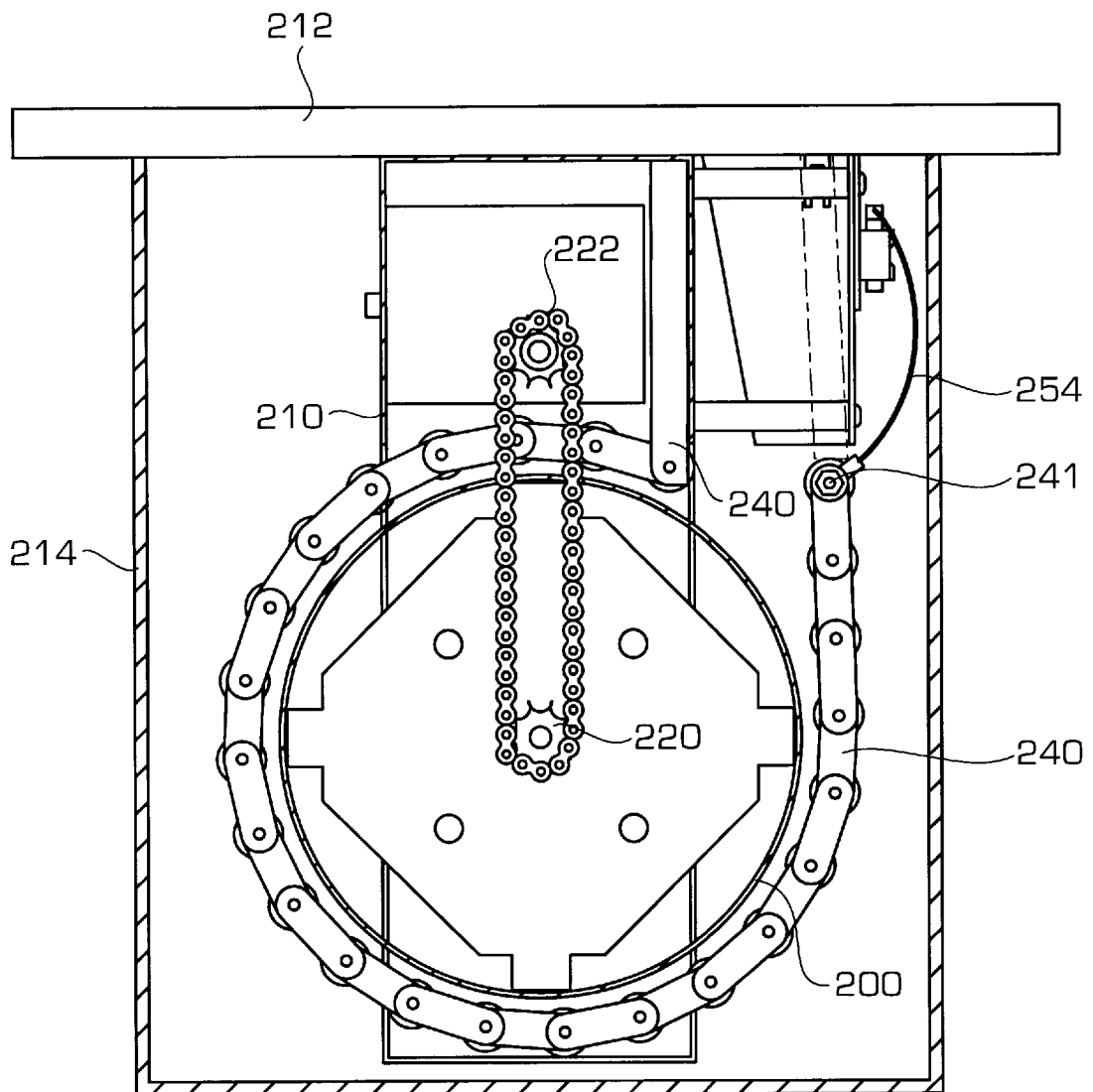


FIG. 20

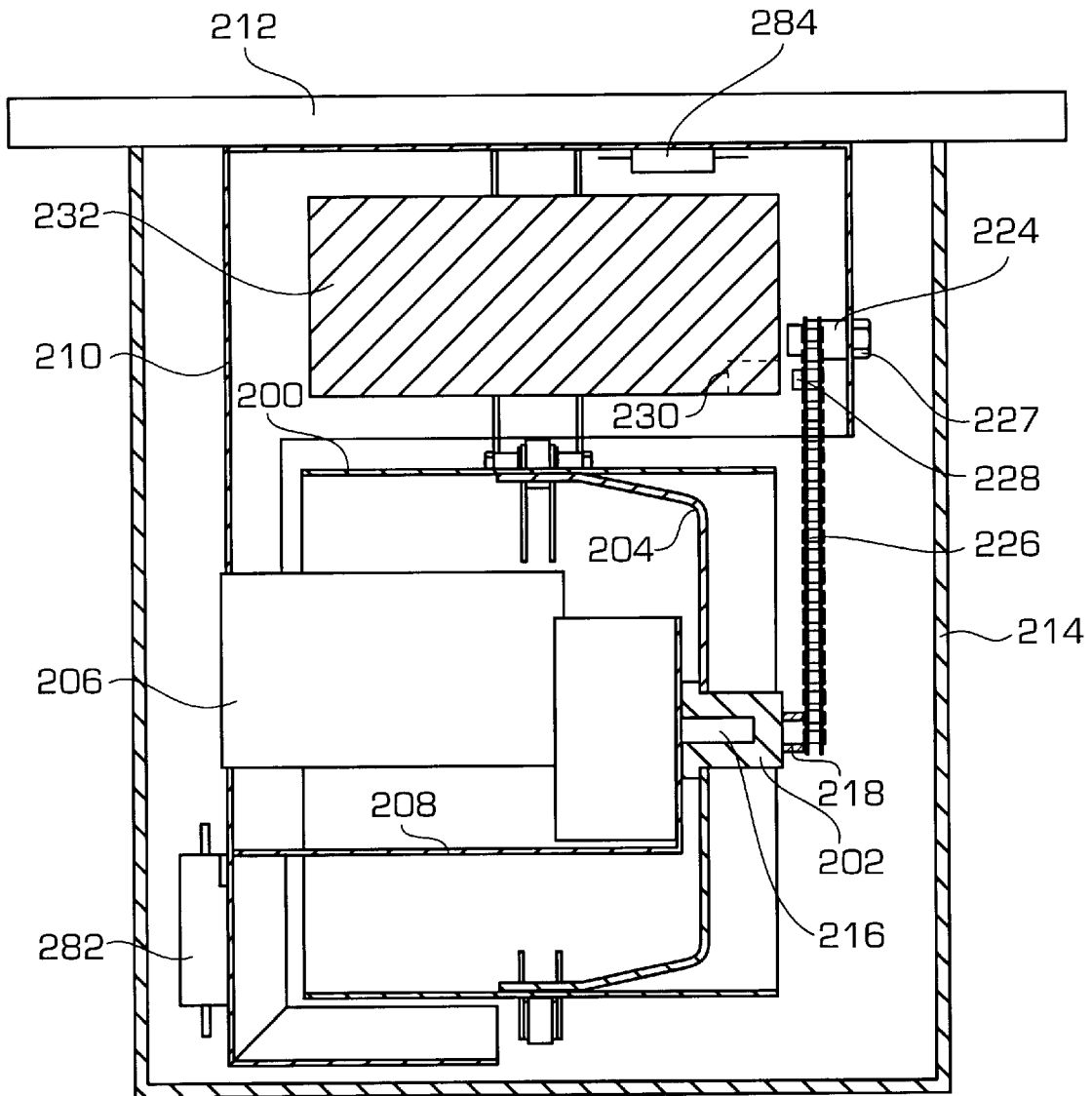


FIG. 21

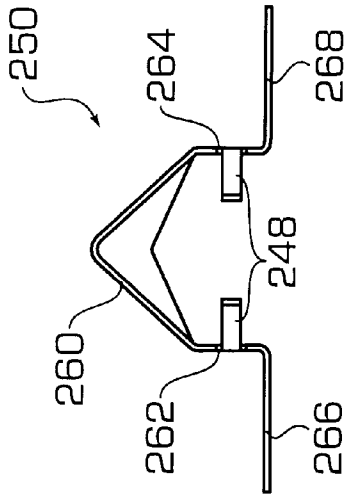


FIG. 22

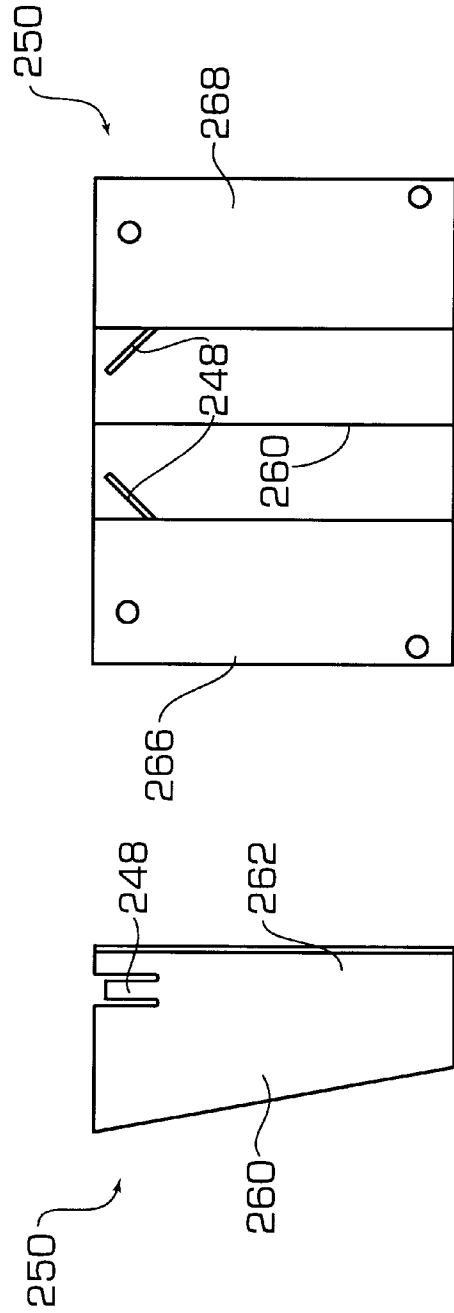


FIG. 23

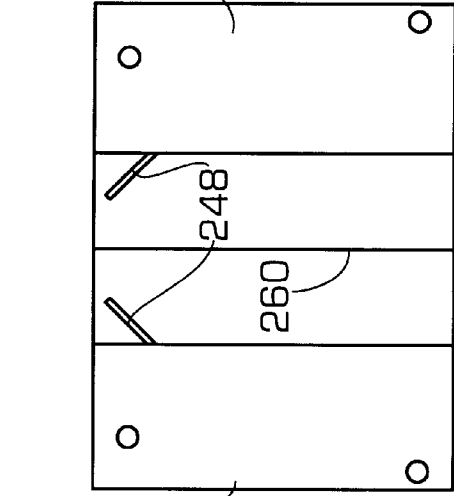
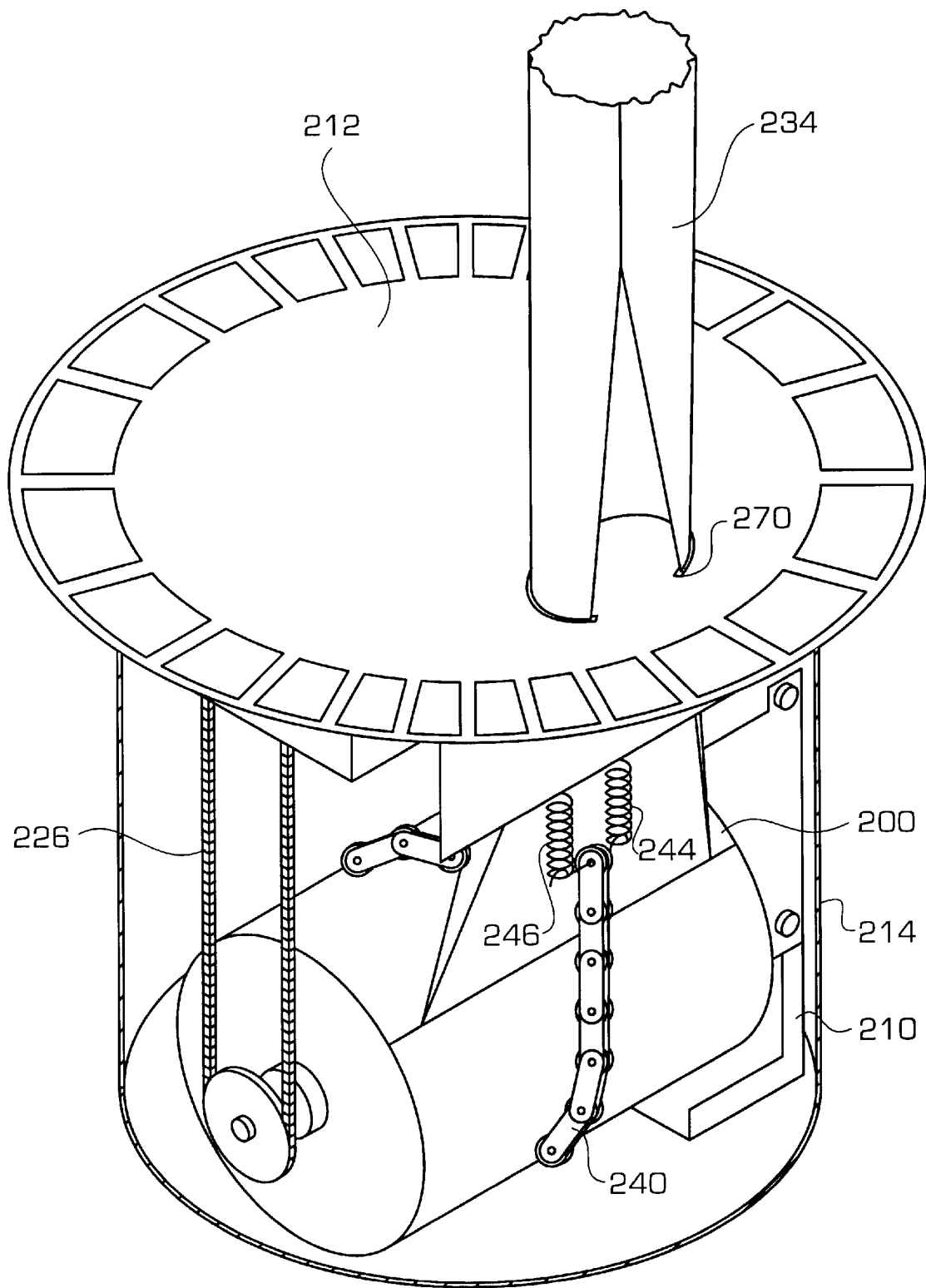


FIG. 24



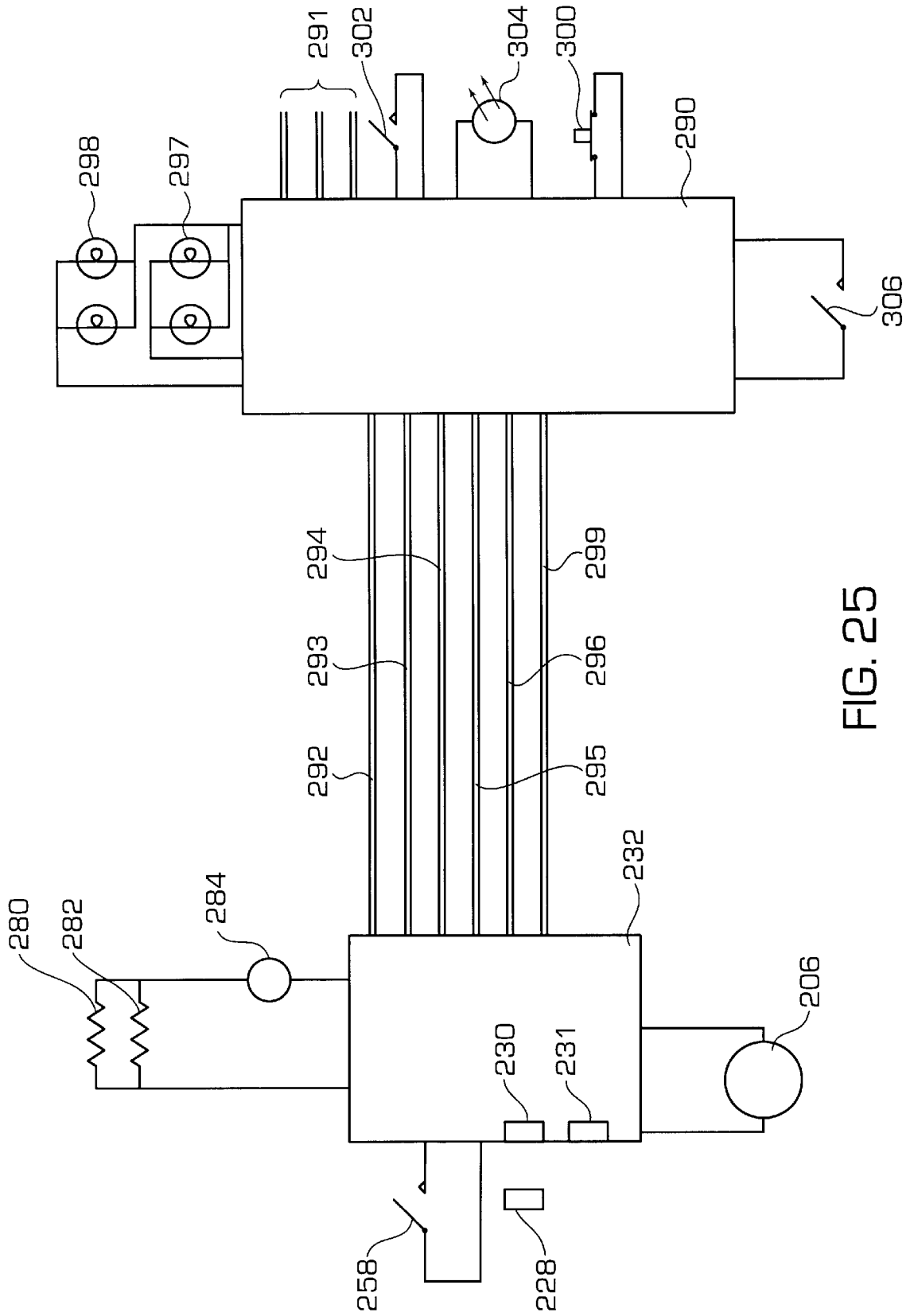


FIG. 25

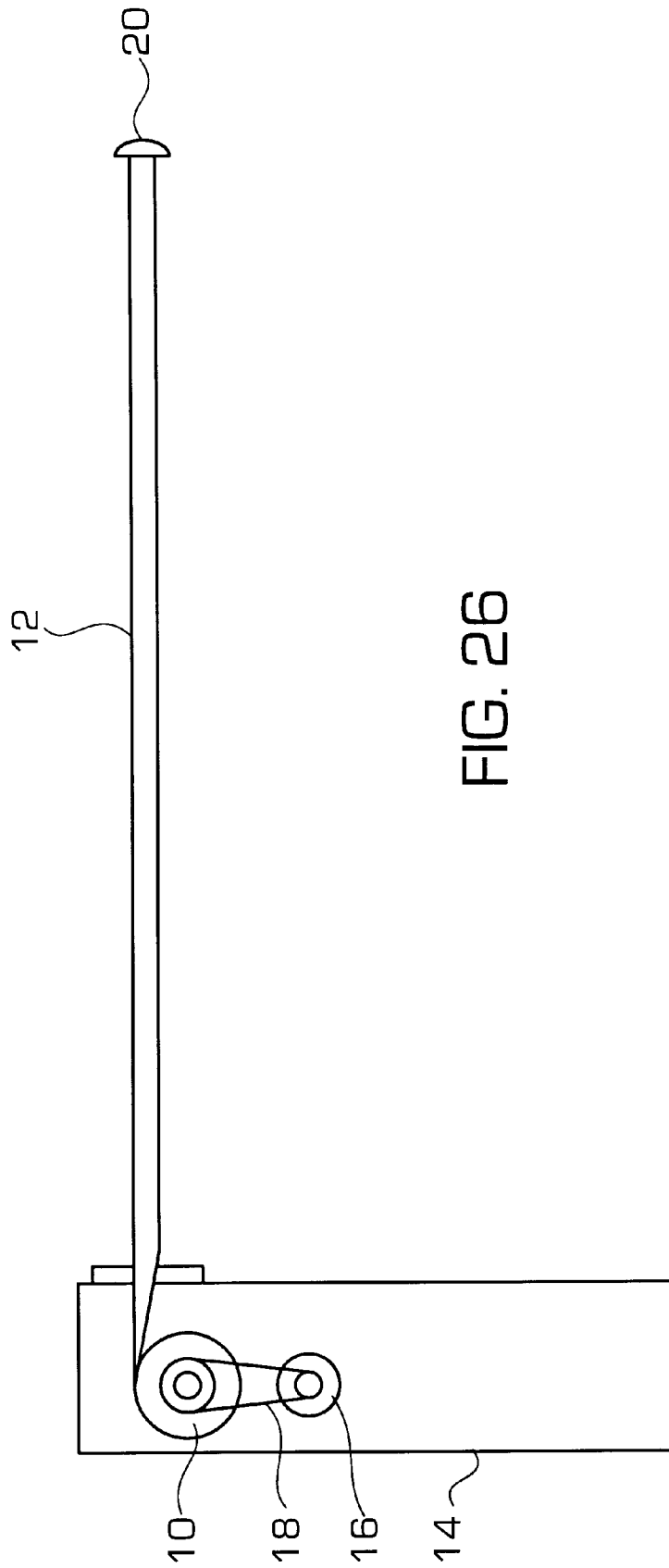


FIG. 26

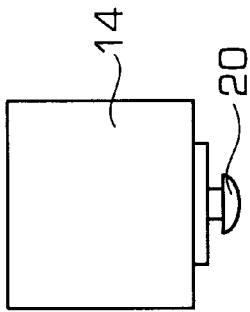


FIG. 29

FIG. 28

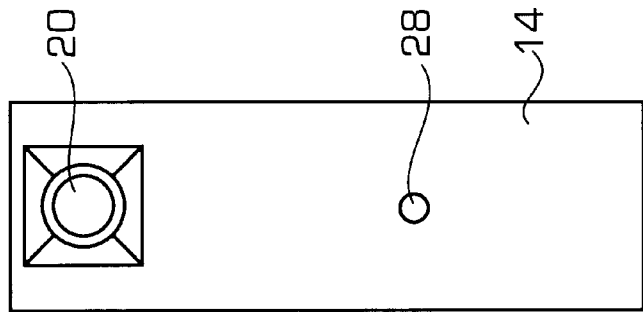


FIG. 30

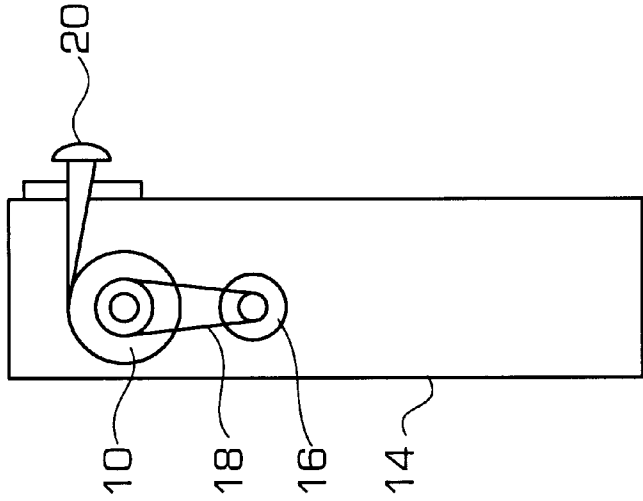
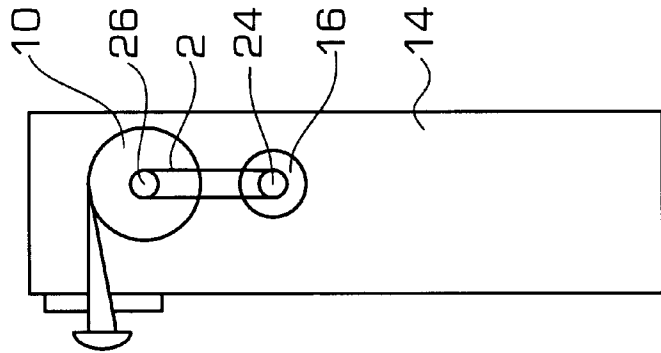


FIG. 27



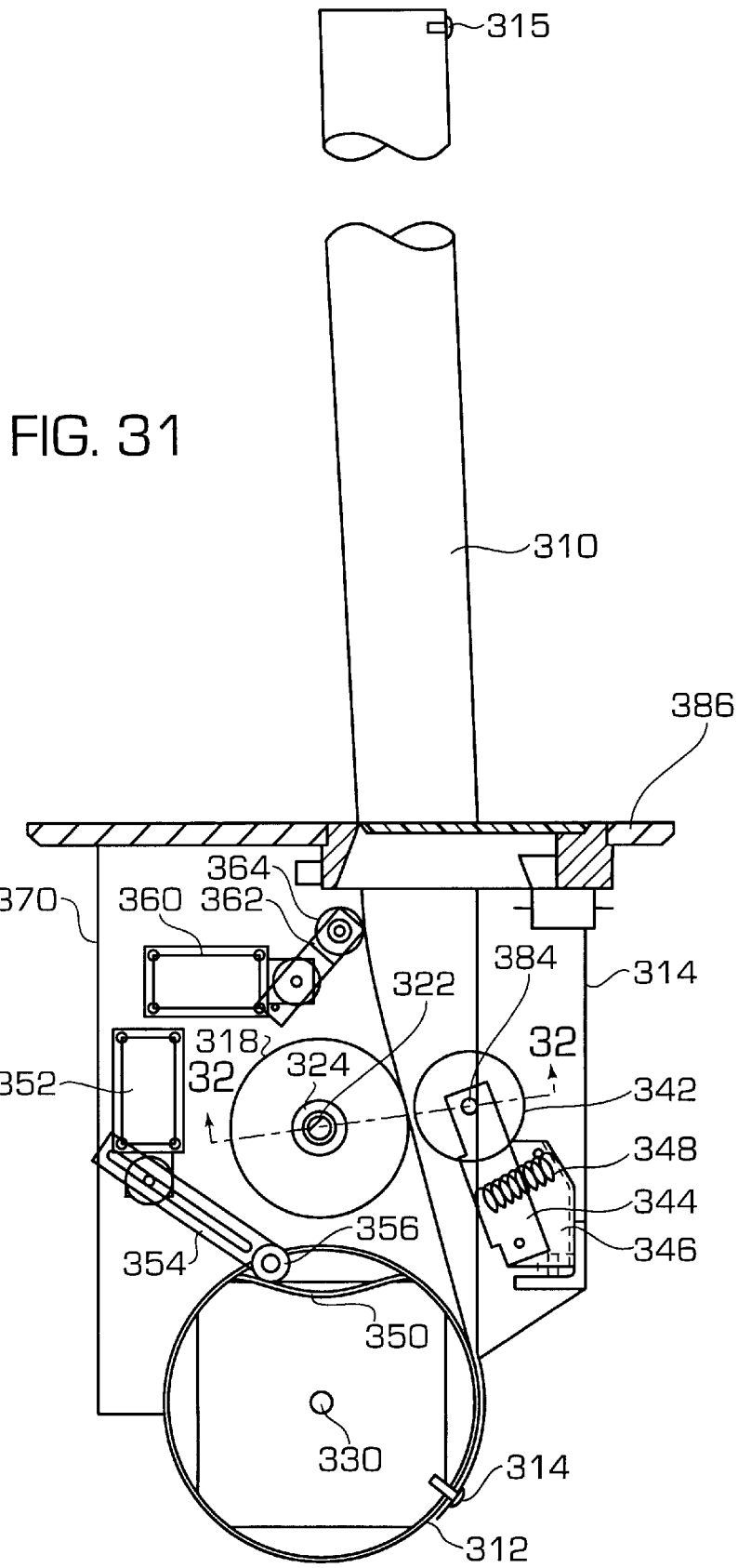


FIG. 32

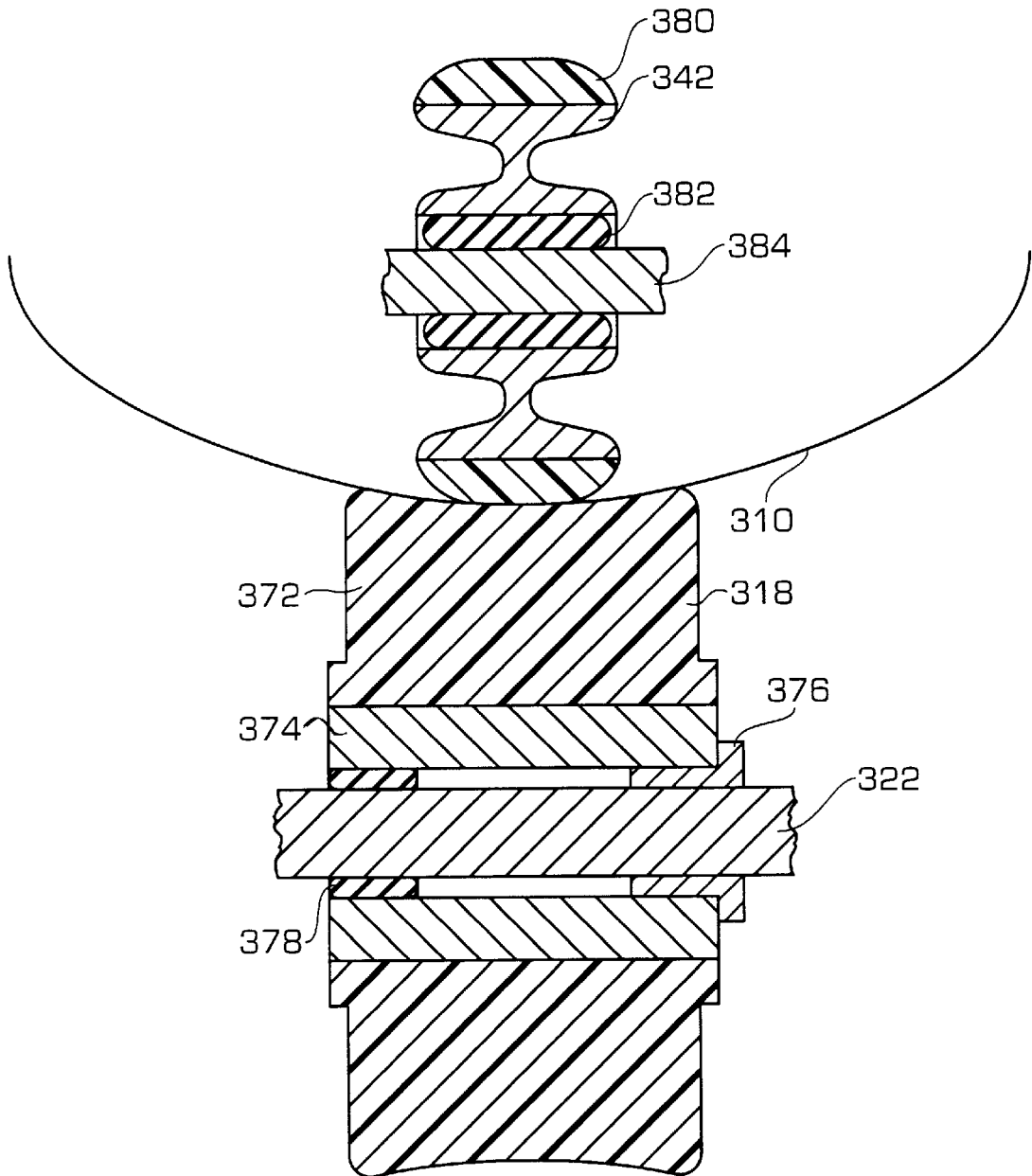
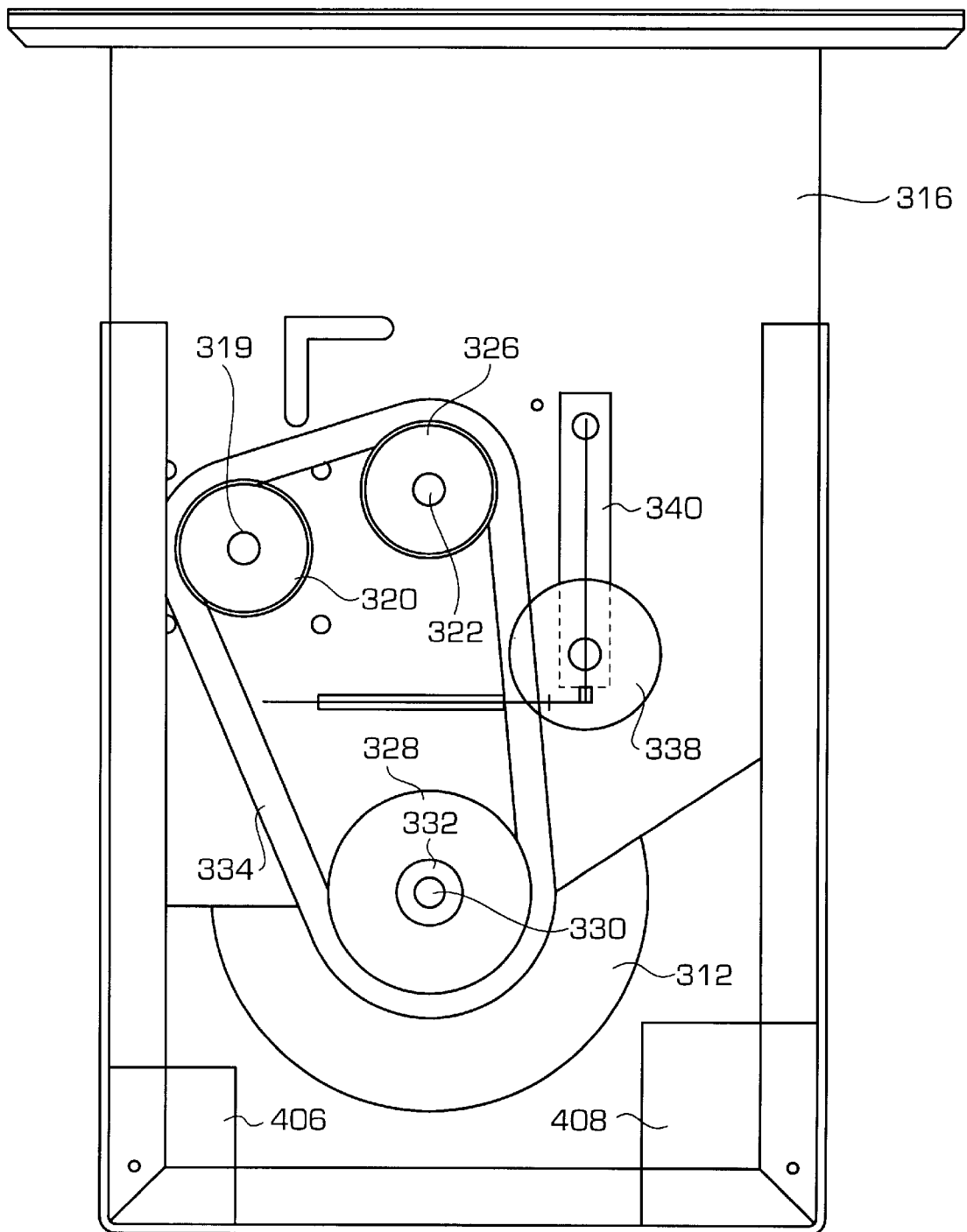


FIG. 33



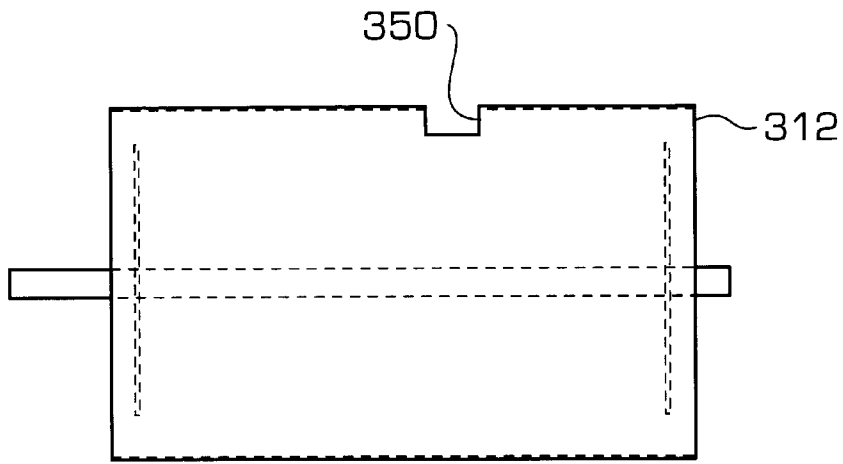


FIG. 34

FIG. 35

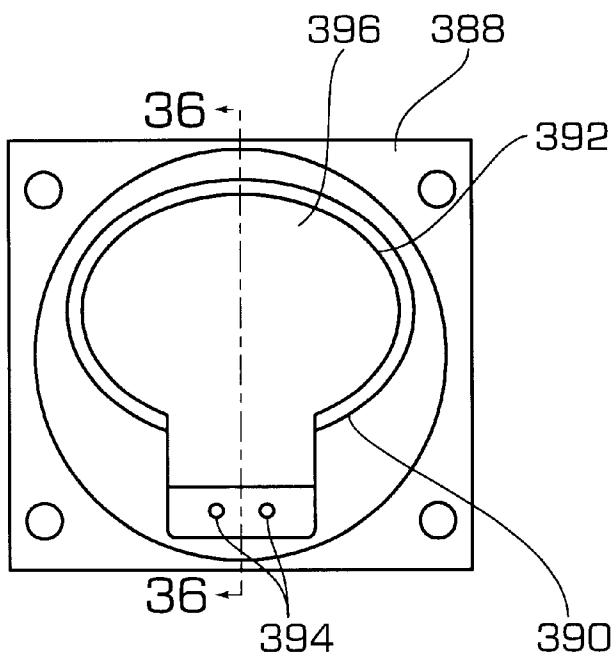
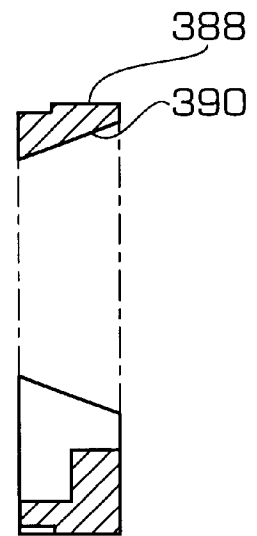


FIG. 36



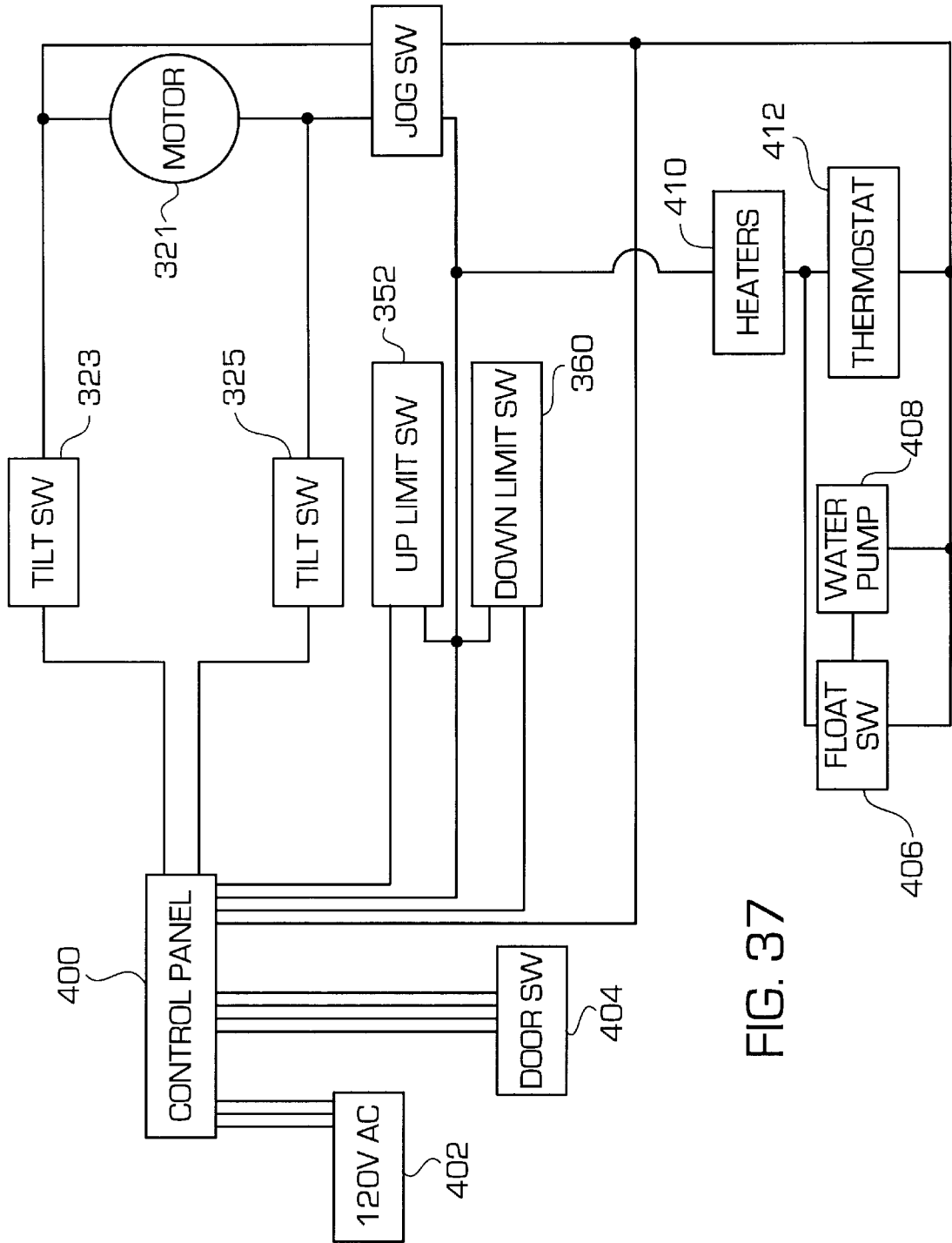


FIG. 37

EXTENDIBLE AND RETRACTABLE POLE**RELATED APPLICATIONS**

The present application is a Continuation-in-Part of application Ser. No. 09/153,038 filed Sep. 15, 1998 now abandoned, which in turn is a continuation-in-part of application Ser. No. 08/949,406 filed Oct. 14, 1997 now U.S. Pat. No. 5,964,059. Applicant also claims priority benefits of provisional application 60/101,821 filed Sep. 25, 1998 under 35 U.S.C. § 119(e).

BACKGROUND OF THE INVENTION

The present invention is directed to an extendible and retractable pole which may be mounted for vertical or horizontal deployment for traffic control, such as controlling the movement of trucks toward and away from a loading dock or controlling the movement of vehicles in other situations.

Many mechanical and electrical devices have been produced over the years in an attempt to increase safety at loading dock areas. All of these devices have had significant problems to the extent that the desired safety factor has not been achieved.

The mechanical devices are generally of the type which provide a physical restraint to prevent the truck from pulling away from a loading dock accidentally or intentionally while a loading or unloading operation is still being performed. Such mechanical devices however have proven to have high maintenance costs and do not work on all types of trucks. Numerous configurations of mechanical devices have been tried and new ICC bar regulations threaten to complicate the design process of such mechanical restraining devices.

The electrical devices utilized in the past include traffic lights, horns and electric wheel chocks. However, all of these have proved to be inadequate in order to achieve the desired safety factor. The principle difficulty with such electrical devices is that if a truck driver is not aware of the device, he can still pull away from or back into a dock without knowing of any danger.

An extensive review of accident reports at loading docks provided by OSHA and surveys with building owners revealed a surprising statistic. In well over 90% of personal injury cases, the cause of the accident was miscommunication. Frequently a driver did not know that someone was working on a dock or had not finished loading a truck. A further review showed that most of the accidents occurred while backing into the loading dock, not pulling out prematurely.

After review of the statistics and surveys, one common denominator began to appear. It became clear that if some kind of signal device could be provided in front of the loading dock and in front of the truck driver, most of the accidents could be avoided. If you can put some type of physical barrier in the path of a driver, he will not run over it. While several types of existing barriers are known, such as railroad crossing gates or barriers which can be pivoted between a horizontal ground level position and a vertical upstanding position, such barriers generally are unacceptable since the barrier would interfere with truck positioning as well as snow removal on the dock pad. Furthermore, if such rigid devices were accidentally hit by the truck, the barrier would be destroyed.

Examples of such barriers are found in the U.S. patents to Quante (U.S. Pat. No. 4,713,910), Fletcher (U.S. Pat. No. 4,901,071) and Caldwell (U.S. Pat. No. 5,146,710). The

device in each of these patents is comprised of a pole which can be pivoted from a horizontal ground level position to a vertical position to provide a barrier post for parking lots and passageways. The patent to Quante also discloses an embodiment wherein the pole can be vertically retracted into a hole in the ground. Each of the barrier posts disclosed in these patents would be severely damaged, generally beyond repair, if struck by a vehicle.

Traffic barriers used in conjunction with a toll facility or a parking facility are usually comprised of a pivoted gate or arm mounted for pivotal movement about a horizontal axis on a support post or column. Such gates or arms are usually made of wood or rigid plastic material which will break off upon accidental impact by a vehicle to prevent damage to the pivot mechanism. Even so, the replacement of a broken gate is expensive and time consuming. Such pivoted gates are sometimes accidentally lowered onto a vehicle causing dents or scratches in the vehicle body.

SUMMARY OF THE INVENTION

The present invention provides an extendible and retractable pole for use in conjunction with loading docks to provide increased safety with respect to truck operations on the dock pad and for use in other vehicle related control situations.

The present invention provides a new and improved extendible and retractable pole comprised of a flat strip of plastic material secured to and wound on a motor driven drum mounted in a canister adapted to be set in the ground in spaced relation to a loading dock and guide means for directing said flat strip of plastic material vertically upwardly upon rotation of said drum in an unwinding direction, said strip of plastic material having a memory whereby upon extension of the strip in the vertical direction, the strip will automatically form into a cylindrical pole to warn a truck driver not to approach or leave a loading dock.

The present invention provides a new and improved safety pole for use in conjunction with a loading dock whereby the safety pole will be automatically extended and retracted when an overhead door on the loading dock is raised and lowered, respectively.

The present invention provides a new and improved extendible and retractable pole which is substantially indestructible even if the pole is bent inadvertently by vehicle contact since the pole will be automatically restored to its vertical, cylindrical configuration upon removal of the vehicle due to the inherent memory of the plastic strip.

The present invention provides a new and improved extending and retractable pole comprised of a flat strip of plastic material secured to and wound on a motor driven drum and mounted on the upper end of a vertically disposed support member. The drum has a horizontally disposed axis of rotation and guide means for directing said flat strip of plastic material outwardly of the housing in which the drum is mounted in a horizontal direction upon rotation of said drum in an unwinding direction. The strip of plastic material has a memory whereby upon extension of the strip in the horizontal direction, the strip will automatically form into a cylindrical pole to act as a gate for regulating the flow of traffic past the gate in response to automatic or manual controller means.

The above and other objects, features and advantages of the present invention will be more apparent and more readily appreciated from the following detailed description of preferred exemplary embodiment of the present invention, taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing the relationship of a safety pole, a truck and a loading dock with the truck in contact with the loading dock and the safety pole in the elevated position.

FIG. 2 is a view similar to FIG. 1 showing the truck in transition with the safety pole retracted.

FIG. 3 is a view similar to FIG. 1 with the truck completely out of the loading area and the safety pole in the retracted position.

FIG. 4 is a front elevational view of an extendible and retractable pole according to a first embodiment in the retracted position within a canister and wound on a motor driven drum rotatably mounted within the canister, the canister being shown in section.

FIG. 5 is a view similar to FIG. 4 with the pole in the extended position.

FIG. 6 is a sectional view taken on the line 6—6 in FIG. 4.

FIG. 7 is a sectional view taken along the line 7—7 in FIG. 4.

FIG. 8 is a top plan view of the canister with the cover secured thereon.

FIG. 9 is a sectional view, taken along the line 9—9 of FIG. 4 showing the pole clamping mechanism with the clamp in the open condition.

FIG. 10 is a sectional view similar to FIG. 9 with the pole clamping mechanism with the clamp in the clamped condition.

FIG. 11 is a partial sectional view showing a side elevational view of the mechanism within the canister.

FIG. 12 is a partial sectional view of the canister showing a side elevation view of the internal mechanism in the canister showing different components in section.

FIG. 13 is a plan view of the plastic strip with the center portion broken away, showing the ends of the plastic strip in a flat condition.

FIG. 14 is an elevational view of the pole with the center portion broken away, showing the cylindrical configuration of the plastic strip.

FIG. 15 is a sectional view taken along the line 15—15 in FIG. 14.

FIG. 16 is a schematic view of the circuitry for controlling the raising and lowering of the extendible and retractable pole when used as a safety pole.

FIG. 17 is a front elevational view of an extendible and retractable pole according to a second embodiment in a retracted position within a canister and wound on a motor driven drum rotatably mounted within the canister, the canister being shown in section.

FIG. 18 is a view similar to FIG. 17 with the safety switch mounting plate removed.

FIG. 19 is a side elevational view of the canister and drum shown in FIG. 17 with the canister being shown in section.

FIG. 20 is a rear elevational view partly in section of the assembly shown in FIG. 17.

FIG. 21 is a top plan view of the center guide for the pole.

FIG. 22 is a side elevational view of the center guide shown in FIG. 21.

FIG. 23 is a front elevational view of the center guide as shown in FIG. 21.

FIG. 24 is a perspective view of the canister, partly in section illustrated in the formation of the pole as the plastic

strip unwinds from the drum and passes through a C-shaped slot in the canister cover.

FIG. 25 is a schematic circuit diagram with respect to the second embodiment.

FIG. 26 is a side elevation of a further embodiment according to the present invention showing a horizontally disposed, extendible and retractable pole mounted on a vertically extending post for controlling the flow of traffic.

FIG. 27 is a side elevation view of the opposite side of the post shown in FIG. 26 with the pole retracted.

FIG. 28 is a front elevation view of the pole shown in FIG. 27.

FIG. 29 is a top plan view of the pole as shown in FIG. 28.

FIG. 30 is a side elevation view similar to FIG. 26 with the pole retracted.

FIG. 31 is a side elevational view partly in section of an alternative drive arrangement for an extendible and retractable plastic pole suitable for use with the vertical safety pole shown in FIGS. 1—3 or the horizontally mounted traffic barrier as shown in FIGS. 26—30.

FIG. 32 is a partial sectional view taken along the line A—A in FIG. 31.

FIG. 33 is an end elevation view of the drive arrangement for the roller and drum shown in FIG. 31.

FIG. 34 is a side view of the drum shown in FIG. 31 showing the location of the peripheral groove.

FIG. 35 is a plan view of the cover plate and sealing member associated with the opening therethrough.

FIG. 36 is a sectional view taken along the line A—A in FIG. 35.

FIG. 37 is a schematic circuit diagram for controlling the arrangement shown in FIG. 31.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is comprised of two basic embodiments, both utilizing an extendible and retractable plastic pole which may be wound up flat on a drum for storage purposes. According to the first basic embodiment, the pole is disposed in a canister set in the ground for movement up and down in a vertical direction. According to the second basic embodiment of the invention, the pole is mounted for horizontal movement on the top of a support post. The present invention is also directed to several different embodiments of drive arrangements for extending and retracting the pole. The various drive arrangements may be used for either the vertical or horizontal pole embodiments.

The pole according to the present invention can be used as a safety pole 20 in conjunction with a building 22 having a loading dock 24. The safety pole 20 is spaced from the loading dock 24 approximately 80 feet or a distance sufficient to accommodate the longest tractor trailer unit 26 on the road today. The unit is conventionally backed up to the loading dock 24 and an overhead door 28 is retractably mounted inside the building for opening and closing the loading dock. When the overhead door 28 is in the raised position as shown in FIG. 1, the safety pole 20 will automatically be extended vertically in front of the truck to warn the driver not to pull away from the loading dock since the overhead door 28 is in the raised position.

The safety pole is adapted to be retracted into a canister 30 located below ground level. The pole 20 may be retracted

onto a motor driven drum located in the canister. The motor is connected by wires extending through a conduit **32** to the drive unit **34** for raising and lowering the door. Once the loading operation is completed, the door **28** will be lowered and the safety pole **20** will automatically be retracted into the canister **30** as shown in FIGS. **2** and **3**. If the overhead door **28** is raised for any reason when a truck is not present at the loading dock, the safety pole **20** will automatically be extended to the position shown in FIG. **1** to warn truck drivers not to approach the loading dock.

The details of the pole and the mechanism for extending and retracting the pole according to a first embodiment are shown in detail in FIGS. **4-15**.

The hollow cylindrical drum **42** is connected to and supported by a pair of drum caps **46** and **48**. The drum cap **48** is provided with a hub portion **66** which is rotatably supported in a vertically extending frame member **56** by means of a bearing **68**. The output shaft **50** from a gear box **51** connected to the output shaft of an electric motor **52** is secured to the hub **66** by means of a set screw **64** whereby rotation of the output shaft **50** will be imparted to the drum **42**. The motor **52** and the gear box **51** are supported by a frame member **53** which in turn is support on a fixed hub **67** and the drum cap **46** of the drum **42** is rotatably supported on the hub **67** by means of a bearing **68**. Thus, the motor is contained completely within the drum and is protected from dirt or any other debris which might enter the canister **30**.

The two frame members **56** which support the drum **42** are secured to the ends of a plate **90** secured to the under surface of the top **86** of the canister **30**. A base **94** is secured to the frame members **56** by any suitable means and a heating element **92** is secured to the lower surface of the base **94** by any suitable means. The top **86** of the canister is secured to the canister **30** by means of screws **98** which are connected to support brackets **100** secured to the internal surface of the canister **30** adjacent the top edge thereof, as shown in FIG. **12**. The canister top **86** is provided with a hole **102** having tapered side walls. A cover **104** having side walls complimentary to the sides of the hole **102** is provided to close the hole **102**. The cover **104** is provided with a downwardly extending cylindrical projection **105**. The upper end of a plastic strip **40** which forms the pole **20** is connected to the projection **105**, as shown in FIG. **12**. With the cover **104** in the closed position, the plastic strip **40** is wound up in flat condition on the drum **42**. Since the entire motor driven drum assembly and heating element are mounted from the top **86** of the canister **30**, the entire assembly will be suspended above the bottom **106** of the canister **30** so that it will not be sitting in water should any water leak into the canister **30**. A suitable drain hole (not shown) may be provided in the bottom wall **106** to drain any water which might enter the canister **30**.

A notch **87** is cut in the top edge of the canister **30** adjacent to the top **86** as shown in FIG. **5** through which the wires **65** for the motor, the wires **93** for the heater and various other wires (not shown) from the switches and solenoids may exit the canister. After the wires are located in the notch **87** the notch may be sealed with an epoxy or other sealer (not shown).

The plastic strip **40**, which forms the pole **20**, is shown in detail in FIGS. **13, 14** and **15**. In FIG. **13**, the strip **40** is shown in the flat form in which it would be wound on the drum **42**. The end **39** of the plastic strip **40** is tapered to form a tab **41** having a pair of apertures **43** extending there-through. The uppermost end of the plastic strip **40** is squared off and provided with a pair of attachment holes **45**. Suitable

fasteners **113** (FIG. **11**) are provided for securing the tab **41** to the drum **42** through the holes **43**. The opposite end of the plastic strip **40** is secured by means of fasteners **115** to the cylindrical extension **105** on the cover **104** as shown in FIG. **12**. When the plastic strip **40** is fully retracted on the drum **42** within the canister **30**, as shown in FIGS. **4, 11** and **12**, the end portion of the plastic strip will remain wrapped about the center guide **44** as shown in FIG. **4**.

Since the strip **40** is in transition between a cylindrical configuration at the top end and a flat configuration on the drum **42**, a pair of slots **46** are formed in the strip **40** to accommodate the transition. Thus wedge shaped gaps will appear in the pair of slots **46** as seen in FIGS. **4** and **11**.

The plastic strip is extended into the position shown in FIG. **5**. The upper end of the plastic strip will extend beyond the top **86** of the canister **30** and the plastic strip will assume a tubular configuration as best seen in FIG. **14**. With the strip **40** fully extended, the tab will still be secured to the drum as shown in FIG. **11**. Due to the fact that the plastic strip **40** initially has a somewhat oval configuration as it is being formed into a cylindrical tube about the center guide element **44**, the hole **102** in the cover **104** has a substantially oval configuration, as best seen in FIG. **8**. The center guide **44**, about which the plastic strip **40** is formed, is provided with a hollow center portion **78** as shown in FIG. **12** and the guide element **44** is mounted on a C-shaped bracket **80**, which in turn, is mounted on the bottom plate **94**. A limit switch **82** is mounted on the C-shaped bracket **80** and is secured thereto by means of a bolt **81**. An actuator rod **83** for the limit switch **82** is operatively connected to a plunger **79** by means of a cross pin **77** and extends upwardly through the bore **78** in the guide element **44**. The upper end of the actuator rod **83** is spring biased upwardly to terminate slightly above the upper end of the guide element **44** when the pole is in the raised position. Upon lowering the pole, the cover **104** will seat in the aperture **102** and the projection **105** will engage the actuator rod **83** and move it downwardly to actuate the limit switch **82**.

An additionally safety limit switch **110** is mounted on the base member **94** adjacent the limit switch **82**. A bent actuator rod **112** is pivotally mounted in the switch **110** with the end **114** disposed in proximity to the surface of the drum, as shown in FIG. **11**. If, upon raising of the pole, the cover **104** engages an obstacle to stop the raising of the pole, the continuous running of the motor will cause the plastic film **40** wound on the drum **42** to bulge outwardly from the surface of the drum, whereupon the plastic film **40** will engage the end **114** of the actuator rod **112** to move the rod and operate the limit switch **110** to shut off the motor.

A further limit switch **120** is mounted on a bracket **122**, which in turn is mounted on the frame member **56**, as best seen in FIG. **4**. The limit switch **120** is provided with a pivoted feeler **124**, the end of which is disposed in engagement with the plastic film **40** when it is in the transition stage from the flat coiled condition to the extended tubular condition as best seen in FIG. **4**. Once the plastic strip **40** is fully extended into the hollow tubular pole form, the plastic strip will no longer engage the feeler **124**, as shown in FIG. **5**, whereby the feeler **124** will be pivoted to a position to actuate the switch **120** and shut off the motor **52**.

Three guide rollers, **140** are located adjacent the periphery of the drum **42** at angularly spaced positions, as shown in FIG. **12**. Two of the rollers **140** are mounted on the base **94** by means of a support bracket **142** and the third roller **140** is mounted on the base member **94** by means of a support bracket **144**. The purpose of the guide rollers **140** is to

prevent the plastic film **40** from uncoiling outwardly in a spiral manner should the raising of the pole be impeded by any obstacle. This will then force the plastic film into engagement with the operating member **112** of the limit switch **110**.

A clamping arrangement for clamping the hollow tubular pole **20** against the cylindrical projection **105** on the under side of the cover **104** is shown in FIGS. **4**, **5**, **9** and **10**. As best seen in FIGS. **9** and **10**, a support strap **150** is secured to the underside of the support plate **90** which in turn is secured to the underside of the cover **86** for the canister. The strap **150** is secured to the plate **90** by means of a pair of bolts **152** and a pair of clamp supporting arms **154** and **156** are pivotally mounted between the strap **150** and the support plate **90** on pivot pins **158** and **160**, respectively. A solenoid **162** is mounted on the underside of the clamp supporting arm **156** on a pivot pin **164**. The armature **166** of the solenoid is connected to a bracket **168** which in turn is pivoted at **170** to the other clamp supporting arm **154**. A pair of clamp members **172** and **174** are secured to the ends of the clamp supporting arms **154** and **156**, respectively, by means of bolts **176**. Each of the clamps **172** and **174** have semi-circular clamping surfaces **178** and **180**, respectively which are adapted to engage and clamp the plastic film **40** against the center guide element **44** when the post **20** is in the fully raised position. The clamps **172** and **174** act as shields to close the hole **102** in the top **86** of the canister **30** when the post **20** is extended to prevent the entry of foreign matter into the canister. When it is desired to lower the post, the solenoid is energized to pivot the arms **154** and **156** and move the clamp members **172** and **174** to the unclamped positions as shown in FIG. **9**.

FIG. **16** shows the control circuitry for the motor and the clamping arms associated with the extended pole retractable pole described above. The motor **52** is a reversible motor and the main motor control is the switch SW1. This switch can be operated in conjunction with the overhead door on a loading dock as described in the example above. The switch SW1 can be operated with conjunction with the operation of the overhead door **28**, so upon operation of the motor **34** to raise the overhead door **28**, the switch SW1 would automatically be moved to initiate raising of the pole. However, it is obvious that the switch SW1 could be controlled by any other arrangement and is not in anyway limited to the operation of the overhead door of a loading dock.

Upon moving the switch SW1 to the close position as shown in FIG. **16**, the power will be supplied through normally closed switch SW2 and normally open switch SW4 which is held in the close position by the pole material when the pole is down and the material is wrapped on the drum. The power will then be supplied to the timer and after a twenty second delay the relay C3 will be operated to supply current to the motor **52** to unwind strip **40** into the raised position to form a pole. The pole will continue up until the switch SW4 opens.

When the switch SW1 is opened, that is moved to the position opposite to that shown in FIG. **16**, power will be supplied to the timer T2 and after a twenty second delay the relay C1 will be energized to move the switch therein to supply power to the motor **52** for rotation in the opposite direction to retrace the pole and wind the strip **40** on the drum. The pole will continue down until the switch SW5 is opened. The timer T2 is provided so that if there is a failure in the switch SW5 or a pole problem after twenty seconds, the motor will shut off and a suitable warning light can be provided to indicate a problem.

If the pole is activated to move into the up position and meets an obstacle, the pole material will buckle causing the

normally open switch SW2 to close thereby supplying power to the relay C2 which will then supply power to the motor **52** to operate in the direction to retract the pole. When the pole is fully wound on the drum, normally closed switch SW3 will open stopping the motor. If switch SW1 is still closed, that is in the door open condition, the timer T1 will not allow the pole to go back up for twenty seconds.

The solenoid **162** for operating the clamps **172** and **174** is wired in conjunction with the motor **52**, so that any time there is power supply to the motor in the up or down condition, the solenoid **162** will be opened to move the clamps **172** and **174** to the open non-clamping position.

The details of the pole and mechanism for extending and retracting the pole according to a second embodiment is shown in detail in FIGS. **17-24**.

A hollow, cylindrical drum **200** is connected a hub **202** by means of an internal support bracket **204** welded or otherwise secured to the interior of the drum **200** and the hub **202**. A motor and gear box assembly are mounted on a motor bracket **208** which in turn is mounted on a main frame **210**, which in turn is secured to the underside of the top **212** of the canister **214** by means of bolts (not shown). The hub **202** and output shaft **216** of the gear box are connected by any suitable means such as splines, set screw or welding whereby the hub and the drum secured thereto will rotate with the output shaft.

The hub **202** is provided with an extension **219** having a sprocket wheel **220** mounted thereon for rotation with the hub **202**. A second sprocket wheel **222** is rotatably mounted on a support spindle **224** which is secured to the main frame **210** by means of a bolt **227**. A magnet **228** is mounted on the timing chain **226** and cooperates with a Hall effect transistor **230** mounted within a compartment **232** which is mounted on the main frame **210**. The compartment **232** contains all of the solid state electronic equipment for controlling the entire operation of the extendible and retractable pole as discussed hereinafter.

A plastic strip **234** is secured to and wound on the drum **200** similar to the arrangement in the first embodiment. However, in lieu of the guide rollers **140** in the first embodiment, a roller chain **240** extends substantially about the entire periphery of the drum in engagement with the plastic strip wound thereon as best seen in FIG. **19**. One end of the roller chain **240** is pivotally connected to a downwardly extending projection **241** of the main frame **210** while the other end of the roller chain **240** is connected to a pin **242** which extends outwardly on either side of the chain as best seen in FIG. **18**. A pair of coil springs **244** and **246** are connected at their lower end to opposite ends of the pin **242**. The upper ends of the springs are connected to opposed projections **248** which are integrally formed with the guide plate **250** which is secured to the main frame by bolts **252**. Thus, as the plastic strip **234** is coiled onto the drum **200**, the diameter of the drum will increase, thereby exerting pressure on the chain to extend the springs **244** and **246**. The end **241** of the roller chain **240** is connected by means of a cord **254** to a pivoted arm **256** of a safety switch **258**. Thus, if the plastic strip **234** encounters an obstacle as it is being extended to form a pole, the plastic strip **234** will tend to unravel radially outwardly of the drum **200** causing the roller chain **240** to move downwardly as viewed in FIG. **17** to operate the safety switch **258** to stop the rotation of the drum **200** in the pole extending mode.

The center guide plate **250** is shown in detail in FIGS. **21-23** inclusive and is provided with a substantially V-shaped central portion **260**, the sides of which are dis-

posed at an 85° angle relative to each other. The V-shaped portion extends into two parallel walls 262 and 264, which terminate in attachment flanges 266 and 268, which are perpendicular thereto. The projections 248 provide the upper anchor for the coil springs 244 and 246 as shown in FIG. 18. The side view of the guide plate clearly shows the 10° inclination of the V-shaped edge 260 relative to the vertical.

The canister cover 212 is provided with a C-shaped slot 270 as shown in FIGS. 17 and 24. As the plastic strip 234 is unwound from the drum 200, the V-shaped guide plate 260 will engage the strip at the center line thereof to gradually initiate the formation of the strip from a flat strip to a curved strip which passes through the C-shaped slot as shown in FIG. 24. Once the plastic strip exits the C-shaped slot 270, the inherent memory of the plastic strip will form the strip into the safety pole 20. The extension and retraction of the pole are controlled by the magnet 228 on the chain 226 which initiates the starting and stopping of the reversible motor 206 which drives the drum 200. The speed of rotation of the motor 206 is reduced by the gear reduction assembly 207 from which the output shaft 216 extends.

A first heater 280 is mounted on the switch supporting plate 258 which in turn is mounted on the guide plate 250. The electric heater 280 is mounted adjacent the canister cover 212 in the vicinity of the C-shaped opening for keeping the opening free of ice and snow to allow the plastic strip to pass freely through. A second heater 282 is mounted on the main frame 210 adjacent the bottom of the canister 214 to assist in the evaporation of any moisture accumulating in the bottom of the canister. Both of the heaters 280 and 282 are operated under the control of a thermostat 284 which is mounted on the upper end of the main frame 210 adjacent the canister cover 212.

The wiring connections for the two heaters, the thermostat, the safety switch, the electric motor and the control switches are shown schematically in FIG. 25.

While the invention has been disclosed as a safety pole for use with a loading dock with the purpose of warning truck drivers not to back-up to or pull away from a loading dock when the pole is in the extended position the safety pole can obviously be used in a number of other situations. A plurality of safety poles could be provided as lane markers in a roadway or parking lot which may be extended or retracted to vary the configuration of the lanes. Also, the safety pole could be used to prevent the unauthorized use of a parking place in a parking garage or a parking lot, wherein an authorized person for the particular parking space would be provided with a coded control for operating the motor similar to a garage door opener remote control. The pole could also be deployed horizontally to act as a gate at a toll facility.

FIGS. 26-30 inclusive disclose a suitable arrangement for extending and retracting the pole when the pole is deployed horizontally to act as a traffic control barrier at a highway toll facility or a parking facility. As shown in FIG. 26, the plastic strip is unwound from a drum 10 mounted for rotation about a horizontal axis to extend outwardly in the horizontal direction as a safety gate 12. The drum 10 is mounted in a support column 14 and driven by a motor 16 through the belt 18. Since a different type of motor is required for the safety pole as opposed to the safety pole, it became necessary to mount the motor 16 for the safety gate outside of the drum 10.

A cap 20 is provided on the end of the pole or barrier 12 which is made of a soft material such as a sponge-like material to prevent damage to the finish of an automobile or

to a passenger in an automobile should the safety gate be extended at the wrong time.

FIG. 27 is a side elevation view of the opposite side of the column 14, as shown in FIG. 26 and shows a timing chain 22 connected between the motor shaft 24 and the shaft 26 of the drum 10. This timing chain is equivalent to and for the same purpose as the timing chain disclosed in the foregoing embodiment directed to a safety pole.

FIG. 28 is a front elevation view of the column 14 and FIG. 29 is a top plan view of the column 14 with the safety gate in a retracted position. A photo sensor 28 is provided in the column 14 for sensing the presence of a vehicle so as to prevent the actuation of the safety gate when a vehicle is passing in front of the column 14.

FIG. 30 is a side elevation view similar to FIG. 26 with the safety gate in the retracted position.

A further embodiment of an apparatus for extending and retracting the pole according to the present invention is disclosed in FIGS. 31-37 inclusive. The pole 310, as shown in FIG. 31, is in the extended position with one end secured to a wind-up drum 312 by means of rivets 314, one of which is shown in FIG. 31. The drum 312, which is shown in section in FIG. 31, is mounted for rotation between two spaced apart plates 314 as shown in FIG. 31 and 316 as shown in FIG. 33. A reversible electric motor (not shown) having an output shaft 319 has a chain sprocket 320 mounted thereon for rotation in opposite directions. A drive wheel 318 is rotatably mounted on a shaft 322 through a one-way clutch 324. A chain sprocket 326 is also mounted on the shaft 322. A chain sprocket 328 is mounted on the drum shaft 330 through a one-way clutch 332. The details of the one-way clutches are old and well known in the art and accordingly are not shown in detail.

The three chain sprockets 320, 326 and 328 are all mounted in a common plane and a drive chain 334 is disposed in engagement with all three chain sprockets. When the motor 320 is driven in the direction to rotate the drum 312 in the clockwise direction as shown in FIG. 31 to wind up the pole 310 on the drum, the chain sprocket 328 will be coupled to the drum shaft 330 through the one-way clutch. However, the one way clutch 324 will allow the chain sprocket 326 and the shaft 322 to rotate without imparting rotation to the drive wheel 318. When the motor is driven in the opposite direction, the drive will be imparted through the one-way clutch 324 to drive the drive wheel 328 in order to extend the pole outwardly of the casing.

An idler chain sprocket 338 is rotatably mounted on a spring biased lever 340 for engagement with the chain 334. A pressure wheel 342 is rotatably mounted on a lever 344 which is pivotally mounted on a bracket 346. The pressure wheel 342 is normally biased toward the drive wheel 318 by means of the spring 348 for gripping the plastic pole between the drive wheel 318 and the pressure wheel 342.

The outer cylindrical surface of the drum 312 is provided with a groove as best seen in FIGS. 31 and 34. A limit switch 352 is mounted on the support plate 314 and includes a pivoted sensing arm 354 having a roller 356 on one end thereof adapted to be disposed in roller engagement with the pole when it is wound up flat on the surface of the drum. When the pole is completely extended, as shown in FIG. 31, the groove 350 will be uncovered, thereby allowing the roller 356 to enter the groove 350, thereby pivoting the arm 354 to actuate the limit switch 352. This determines the full upward limit for the pole and the motor will be shut off. The lower end of the pole 310 will remain connected to the drum by means of the rivets 314. The overlapping ends of the pole

are connected at the outermost end by means of a rivet **315** to help the pole maintain the cylindrical configuration under adverse wind conditions.

A second limit switch **360** is also mounted on the support plate **314** and provided with a pivoted sensing arm **362** having a roller **364** on the outer end thereof adapted to be disposed in rolling engagement with the cylindrically shaped pole **310**. When the pole is retracted into the canister **370**, the lever **362** will be allowed to rotate further in the clockwise direction to actuate the limit switch **360** to de-activate the drive motor.

The details of the drive roller **318** and the pressure roller **342** are shown in the sectional view of FIG. **32**. The outer portion **372** of the drive wheel is comprised of a suitable plastic or rubber material having a circumferential surface with sufficient frictional characteristics to grip the plastic material forming the cylindrical shaped pole. The outer portion **372** is secured to a steel bushing **374** which in turn is supported on the shaft **322** by means of a bronze bushing **376**. A one-way cam clutch **378**, which is shown schematically in FIG. **32**, is also provided between the steel bushing and the shaft **322**, whereby the rotation of the shaft **322** will be imparted to the outer portion **372** upon rotation of the shaft in one direction but not the other. The pressure wheel **342** is provided with an outer peripheral portion **380** of the same material as the outer portion **372** of the drive wheel **318**. A roller bearing **382**, shown schematically in FIG. **32**, is provided between the pressure wheel **342** and the shaft **384** supported by the lever **344**.

Referring to FIGS. **31**, **35** and **36**, the cover **386** provided for the canister or housing in which the apparatus is located, is provided with an insert **388** having an opening through which the plastic material will pass as it is extended and retracted from the roller **312**. At the time the plastic material passes through the opening **390**, the plastic material is not yet formed into a cylindrical pole with overlapping edges. In order to provide a seal to prevent the entry of moisture, a flap **392** of rubber or plastic material is secured to the insert **388** by means of rivets **394**. The flap has an enlarged oval portion **396** which corresponds to the opening **390** but which is spaced sufficiently therefrom to allow for the passage of the plastic material. As the plastic material is fed outwardly of the housing, the flap **392** will flex outwardly and upon winding of the plastic material onto the drum, the flap **392** can flex inwardly with respect to the housing.

The control circuit for the entire assembly is shown in FIG. **37**. The control circuit includes a master control panel **400** which is supplied with voltage from a conventional source **402**. When the assembly is associated with a loading dock, the loading dock is provided with a door switch **404** as previously described to relate the extension and retraction of the pole to the opening and closing of the warehouse door. The motor **321** for driving the chain sprocket **320** is connected through the control panel and the operation of the motor is under the control of the tilt switches **323** and **325**, as well as the up limit switch **352** and the down limit switch **360**. The float **406**, shown schematically in FIG. **33**, and the water pump **408**, also shown schematically in FIG. **33**, as well as the heaters **410** and thermostats **412**, which were previously discussed, are also under the control of the control panel **400**.

The drive arrangement for extending and retracting the pole **310** as shown and described with respect to FIGS. **31-37**, can be used when the pole is located in an in ground canister for vertical movement as well as when the pole is mounted on a post for horizontal movement. When the drive

assembly is mounted on a post for horizontal extension and retraction of the pole, the at and water pump are not necessary and frequently the heaters thermostat can also be eliminated.

While the strip **40** has been referred to as a plastic strip, it is obvious that other type of material having a memory could be used instead of plastic. For example, steel strips can be provided with a curved configuration in the longitudinal direction of the strip in the relaxed condition but which would still enable the strip to rolled up in a flat condition.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An extendible and retractable pole comprised of a housing, a drum rotatably mounted in said housing, motor means for rotating said drum in opposite directions, a flat strip of plastic material secured to and wound on said drum, a cover for said housing having an aperture through which said strip may pass, and guide means mounted in said housing for directing said flat strip of material from said drum outwardly of said housing through said aperture, said strip of material having a shape memory whereby upon extension of said strip outwardly of said housing, said strip will automatically form into a cylindrical shaped pole.

2. An extendible and retractable pole as set forth in claim 1, further comprising pressing means engaging said strip of material on said drum to maintain said strip of material in the flat condition when wound on said drum.

3. An extendible and retractable pole as set forth in claim 2, wherein said pressing means is comprised of a length of roller chain connected at one end to said housing and extending about said drum over a substantial portion of the circumference of the drum, spring means connected between said housing and an opposite end of said chain and safety switch means operatively connected to said opposite end of said chain to stop operation of said motor driven drum upon contact of the strip with an obstacle externally of the housing thereby causing movement of said strip radially outwardly of said drum against said chain.

4. An extendible and retractable pole as set forth in claim 1, wherein said housing is comprised of a canister adapted to be mounted below ground level, a detachable top secured to said housing at ground level having a hole therein through which said strip may extend in a vertical upward manner to provide a safety pole.

5. An extendible and retractable pole as set forth in claim 4, wherein said motor driven drum is mounted on a support frame mounted in a depending manner from said cover to maintain said motor driven drum in vertical spaced relation from a bottom wall of said canister.

6. An extendible and retractable pole as set forth in claim 5, wherein said drum is hollow and rotatably mounted on said frame with said motor being mounted on said frame within said hollow drum.

7. An extendible and retractable pole as set forth in claim 6, further comprising heating means mounted in said housing to prevent build up of snow and ice around said aperture and to evaporate condensation within said housing.

8. An extendible and retractable pole as set forth in claim 1, wherein said housing is mounted on a support and spaced above ground level, said housing having a cover disposed substantially perpendicular to ground level and having a hole therein through which said strip may extend in a horizontal manner to provide a traffic barrier.

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9. An extendible and retractable pole as set forth in claim 8, wherein cushion means are secured to a free end of said strip to cushion impact of said strip against an object in the course of being extended.

10. An extendible and retractable pole as set forth in claim 8, further comprising sensor means mounted on said support for detecting a vehicle.

11. An extendible and retractable pole as set forth in claim 1, wherein said motor means is comprised of a reversible motor and drive means disposed between said drum and said aperture for unwinding said strip of material from said drum to extend said strip outwardly of said housing and transmission means for driving said drum in one direction to wind said strip of material on said drum while disconnecting said motor from said rotatable drive means when said motor is rotating in one direction and for transmitting drive from said motor to said rotatable drive means and disconnecting said

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motor from said drum upon rotation of said motor in an opposite direction.

12. An extendible and retractable pole as set forth in claim 11, wherein said drive means is comprised of a rotatable drive wheel and a spring biased pressure roller for engaging said strip of material therebetween wherein said drive roller and said pressure roller have curved mating peripheral surfaces corresponding to a natural curvature of said strip before leaving said housing through said aperture.

13. An extendible and retractable pole as set forth in claim 1, wherein said pole is defined by edges of said strip overlapping each other and further comprising connecting means for connecting the edges together at an outer end of said pole.

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